HIGHER ORDER THINKING IN THE AUSTRALIAN ARMY SUITE
OF LOGISTIC OFFICER COURSES

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by

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The Chief of Army (CA) has clearly directed the Australian Army's Training Command (TC-A) to provide training and education that "equips soldiers with the intellectual tools they need for creativity" and is prepared to resource "structures that support innovation" as part of his Twenty-first Century Army Capability Requirement campaign. (Leahy 2004, 27) In order to undertake this directive, TC-A must determine the requirements necessary to effectively and efficiently carry out this directive. The current Suite of Logistic Officer Courses (SOLOC) has been recently criticized for failing to meet this requirement with the general perception that there is a distinct lack of higher order thinking competencies within this continuum. Unless the SOLOC is able to include competencies and learning methodologies that foster higher order thinking skills in its junior logistic officers TC-A will be unable to meet the CAs intent in preparation for the twenty-first-century warfighting environment as described within the HNA construct.

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ABSTRACT

HIGHER ORDER THINKING IN THE AUSTRALIAN ARMY SUITE OF LOGISTIC OFFICER COURSES, by Major Scott R. Bradford, 108 pages.

The Chief of Army (CA) has clearly directed the Australian Army's Training Command (TC-A) to provide training and education that "equips soldiers with the intellectual tools they need for creativity" and is prepared to resource "structures that support innovation" as part of his Twenty-first Century Army Capability Requirement campaign. (Leahy 2004, 27) In order to undertake this directive, TC-A must determine the requirements necessary to effectively and efficiently carry out this directive. The current Suite of Logistic Officer Courses (SOLOC) has been recently criticized for failing to meet this requirement with the general perception that there is a distinct lack of higher order thinking competencies within this continuum. Unless the SOLOC is able to include competencies and learning methodologies that foster higher order thinking skills in its junior logistic officers TC-A will be unable to meet the CAs intent in preparation for the twenty-first-century warfighting environment as described within the HNA construct.

ACKNOWLEDGMENTS

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ACRONYMS

ATDP	Army Training and Leadership Development Panel
BAE	Board of Education Affairs
CA	Chief of Army (Australian Regular Army)
CCTDI	California Critical Thinking Disposition Inventory
CSA	US Army Chief of Staff
HNA	Hardened and Networked Army
HQ TC-A	Headquarters Training Command--Army
LOAC	Logistic Officer Advance Course
LOBC	Logistic Officer Basic Course
LOIC	Logistic Officer Intermediate Course
MAP	Military Appreciation Process
SCANS	Secretary's Commission on Achieving Necessary Skills
SOLOC	Suite of Logistic Officer Courses
TC-A	Training Command--Army
TMP	Training Management Plan
TRADOC	Training and Doctrine Command

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CHAPTER 1

COGNITIVE READINESS AND THE TWENTY-FIRST CENTURY
LOGISTIC OFFICER

> In any military organization there is no surer way to
> disaster than to take what has been done for many years, and to go
> on doing it--the problem having changed.

> Field-Marshal Viscount Montgomery of Alamein

Hardened and Networked Army

> It is through the Hardened and Networked Army (HNA)
> that I will ensure that the Army meets its current commitments and
> prepares to meet the challenges of the future. . . . Army must be
> prepared to face a very broad range of activities from the
> conventional defence of Australia to peacekeeping to peace
> making to nation building to humanitarian operations and the
> threat of terrorism. . . . Army requires a force with increased
> flexibility, adaptability and agility. Army must be adept at
> operating in rapidly changing structures where joint, coalition and
> multi-agency operations are a matter of course. … In the complex
> warfare of the 21st Century we are going to need **tough, fit
> warriors**. Our soldiers are to be **leaders**, to be **decision-makers**
> and **ambassadors** for Australia.

> Lieutenant General Peter Leahy, Chief of Army, 2005

The diversity of recent deployments indicates that there has been a fundamental

transformation in geopolitics. The result has been increasing complexity in the conduct of

military operations across a very broad spectrum of conflict. The Hardened and

Networked Army (HNA) is the means by which the Army can provide an increased range

of options to the government in order to deal with an increasingly demanding and

complex future. The Army must become harder to hit and when hit, needs to be able to

hit back harder.[1]

The Australian Army way of war has always rested on the individual soldier. It is

the individual soldier who represents the greatest comparative advantage over potential

enemies. The complex warfighting environment demands from soldiers both creativity and innovation. Creativity is defined as the ability to generate new ideas and solutions to problems, and innovation as being the ability to implement them. Creativity and innovation will support the application of doctrine, not replace it, and will occasionally require time honored ideas and practices to be relinquished. The Army must ensure it equips its soldiers with both the intellectual tools they will need for creativity and the institutional structures required to support innovation.

Just as globalization and the advent of the information age are reshaping the strategies, tactics and tools of business, rapid advances in technology promise to reshape the strategies, tactics and tools of warfare. These same technologies are also available to potential enemies as off-the-shelf products. In this environment, the ability to adopt advantageous technologies and apply them quickly and effectively becomes increasingly important. The Army must ensure it provides our soldiers every opportunity to capitalize on applicable advances in technology. It must also recognize that technology alone does not drive creativity and innovation. Equally important are changes to training and doctrine.

There is an increased need to quickly develop an understanding of enemy actions that are less predictable than in the past and generate fewer significant tactical signatures. The variety and ambiguity of tactical circumstances will demand heightened powers of discrimination, analysis and a readiness to generate novel responses. This will sometimes need to happen without assistance of precedents passed on in the form of doctrine. One element of the solution to this problem might be an increased emphasis on education.

In this complex and lethal environment, soldiers will face increased public and media scrutiny. This means that choosing how operations are conducted is almost as important as choosing what operations are conducted. The demeanor of individual soldiers and their ability to understand and respond to cultural issues are both critically important for success. The strategic corporal is now a strategic private. The strategic private will need to understand the national policy imperatives, limitations and guidance to allow him to make informed judgments. Many of these judgments will be made in an environment characterized by ambiguity and uncertainty. The Army must prepare its soldiers for this challenge.

Chapter Outline

This chapter introduces the reader to the Australian Army's HNA concept, and briefly articulates the impact that the introduction of this concept is likely to have on the Suite of Logistic Officer Course (SOLOC). The aim of this chapter is to introduce the concept of 'higher order thinking' and 'cognitive readiness'. A brief definition of the term 'competency' will also be provided as this area of research will become vital during the Methodology Phase (Chapter 3) of this thesis. These terms form the basis of the Field Study (Chapter 4) and will be utilized to determine the level of higher order thinking currently embedded in the SOLOC. More depth and clarity will be added to these definitions in the Literary Review (Chapter 2).

Hardened and Networked Army and the Logistic Officer--Thesis Construct

The Chief of Army (CA) has clearly directed the Australian Army's Training Command (TC-A) to provide training and education that "equips soldiers with the

intellectual tools they need for creativity" and is prepared to resource "structures that support innovation" as part of his Twenty-first Century Army Capability Requirement campaign.[2] In order to undertake this directive, TC-A must determine the requirements necessary to effectively and efficiently carry out this directive. The scope of this thesis will be limited to analyzing the requirements of the SOLOC within TC-A. Specifically, this thesis will seek to answer the primary question: Does the SOLOC include competencies and learning methodologies that foster higher order thinking skills in its junior logistic officers in preparation for the twenty-first-century warfighting environment as described within the HNA construct?

In seeking the answer to this primary question, the thesis will explore the following themes with respect to the SOLOC: defining Higher Order Thinking from a theoretical perspective; defining the current training/learning environment represented on the SOLOC with the view to comparing it to the current needs identified by the CA;

defining the training/learning competencies and methodologies being applied within the SOLOC from a theoretical perspective; defining the training/learning provided to instructors in higher order thinking instruction; and defining where on the life-long learning/training continuum the SOLOC fits for logistic officers. The Army's officer training and education systems are key to inculcating full spectrum operations doctrine throughout the Army and developing leaders who know "how to think."

Anecdotal evidence suggests that some senior officers in the Australian Army are now reporting that the quality and relevance of the SOLOC is not meeting the expectations or needs of many officers or the needs of the HNA concept. This argument is based on two reasons: namely the competencies and learning methodologies that

constitute the SOLOC do not specifically include higher order thinking skills or dispositions; and the instructors for the SOLOC are not adequately prepared to instill higher order thinking skills and dispositions within their classes.

Further to this concern, it appears evident that within the construct of the HNA framework, the demands upon the Australian Army logistics officer are likely to increase. The introduction of revolutionary equipment and new technologies will have a significant impact on the skill-set required by the junior to middle ranking logistic officer. Rapid advances in the arena of information technology, increasingly short timeframes, ambiguous data feeds, and limited lead-times are likely to result in a requirement to identify the training/learning implications specific to the SOLOC. As such, it can be argued that these revised training competences within the SOLOC will need to move away from knowledge acquisition towards cognitive skills acquisition to prepare officers to know "how to think" not "what to think."

<u>A Systems Model of Human Behavior</u>

Regardless of context or setting effective learning requires an understanding of human behavior. Huitt suggests that there is wide support that the human mind is comprised of three basic functions: *cognition* (knowing, understanding, thinking); *affect* (attitudes, predispositions, emotions, feelings); and *conation* (intentions to act, reasons for doing, volition, will).[3] Cognition refers to the process of coming to know and understand--the process of encoding, storing, processing, and retrieving information. It is generally associated with the question of "what?" (what happened; what is going on now; what is the meaning of that information?). It includes mental actions traditionally linked with "thinking" such as analyzing, comparing, assuming, inferring, questioning,

contrasting, or evaluating. The cognitive function is concerned with conceptualizing, reasoning, and comprehending.

Affect refers to the emotional interpretation of perceptions, information, or knowledge. It is generally associated with one's attachment (positive or negative) to people, objects or ideas and asks the question, How do I feel about this knowledge or information? The term "emotional intelligence" has been coined to describe attributes and skills related to this concept.[4]

Conation refers to the connection of knowledge and affect to behavior and is associated with the issue of "why." It is the personal, intentional, playful, deliberate, goal-oriented, or striving component of motivation, the proactive (as opposed to reactive or habitual) aspect of behavior.[5] It is closely associated with the concept of volition, defined as the use of will, or the freedom to make choices about what to do. Conation is our ultimate driving force. Within this function lie our agendas, purposes, goals, values, desires, drives, motivations and commitments. This is the mind's engine, which revs us up and moves us forward toward some action, slows us down, or leads us to back away from some action. It is absolutely critical if an individual is to successfully engage in self-direction and self-regulation.[6]

In summary, the human mind comprises three basic functions: cognition or reasoning, affect or emotion, and conation or volition/will. Despite the fact that cognition, affect and conation are equally important functions of the mind, it is cognition, or thinking, which is the key to the other two. To change a feeling, the thinking that ultimately leads to the feeling must be identified. To change a desire, again the thinking underlying the drive must be identified and altered if our behavior is to alter.

The question that logically results from this discussion is how can one seek to improve higher order human thinking? One place to begin is in defining the nature of thinking. Before making it better, one needs to know what it is. Bloom's taxonomy of cognitive domain serves as a foundation for what are now called higher order thinking skills. This taxonomy helps to create a standard around which further work could be done with the concepts of higher and lower order thinking. Bloom's model included six levels of thinking: knowledge, comprehension, application, analysis, synthesis and evaluation. Each level asks more of our thinking skills and includes the previous levels as subsets of the new level.[7]

Readiness vs Effectiveness

Readiness and effectiveness are ubiquitous terms in militaries throughout the world. When considering the area of cognitive readiness it is important to understand the difference between the terms "*effectiveness"* and "*readiness."* From a military perspective, "*effectiveness* refers to the summative evaluation of a unit or an individual performing a military operation." It is usually measured as performance on some outcome or outcomes associated with mission (especially combat mission) success. "*Readiness*, in contrast, refers to the potential of units or individuals to perform well in combat or in other military operations." It is usually measured by assessing a subset of hypothetical elements or components of effectiveness. Thus, readiness represents an estimate or prediction of effectiveness.[8]

Effectiveness is a more direct measure of operational competence. However, reliable measures of the unit's effectiveness are only available after the fact--after the operation has been carried out. Further, the unique circumstances of every engagement

limit the information these measures can provide about overall unit effectiveness. Assessments of a logistic officer's field performance at live simulation centers provide surrogate measures of effectiveness, but such measures are expensive to obtain and limited in the range of operational environments they cover. Assessments of performance in constructive and virtual simulations complement those obtained from the field, are less expensive to obtain, and allow measurement of some capabilities that cannot be obtained in the field; however, their relationship to operational effectiveness is indirect. Readiness measures provide additional, practicable options for assessing unit capability, preparation, and likely mission performance.

Currently, Australian Army units are periodically evaluated for *combat readiness*, but there is no formal (or summative) assessment for *cognitive readiness*. It may be argued that both areas are equally important to ensure that both mental and physical readiness is maintained at a satisfactory standard.

<div align="center">Cognitive Readiness</div>

The combat multiplier effect gained by a forces that displays sound cognitive readiness is an issue of debate within militaries throughout the world. *"Cognitive readiness* is the mental preparation (including skills, knowledge, abilities, motivations, and personal dispositions) an individual needs to establish and sustain competent performance in the complex and unpredictable environment of modern military operations."[9] The concept of cognitive readiness may be of special relevance and significance for those who must adapt quickly to rapidly emerging, unforeseen challenges.

As implied by the adjective "cognitive," the primary factors that determine cognitive readiness are psychological in nature. This is not to deny that other factors, such as sociological and health variables, can affect cognitive readiness. Such variables, however, are regarded as catalysts that facilitate or inhibit cognitive readiness, rather than primary factors. At the same time, these psychological factors are not limited to those directly associated with traditional cognitive (intellectual) variables, but include other factors, such as personality and disposition, motivation and emotion, and beliefs and attitudes.[10]

In the ordinary course of training, both individuals and units can be prepared to perform many of the essential tasks that are *anticipated* as necessary for accomplishing their missions. Such preparation can be accomplished and assessed in advance of specific operations. However, the readiness of individuals and units to acquire the additional capabilities needed to meet the *unexpected, unforeseen challenges* that inevitably arise in today's asymmetric operational environments remains an essential component of their preparation. Their readiness to rise to these challenges will contribute substantially to the success of their operations. Readiness of this sort concerns their ability to expect the unexpected and be ready to deal with it rapidly and successfully. Metrics for readiness of this sort are necessarily keyed to more abstract capabilities than those that are now included in readiness assessments.

In developing the concept of cognitive readiness, Morrison and Fletcher (2003) have emphasized the requirement to perform competently in the modern battle space, which is characterized as complex, dynamic, and resource limited. The implication is that individual soldiers must be mentally prepared to sustain performance while facing

combat stressors such as information overload, information uncertainty, social isolation, fatigue, physical discomfort, and danger. This environment requires more than simple endurance. It requires the soldier to be flexible, and even creative, in responding to the challenges presented by the surrounding chaos of military operations.

Standard techniques of readiness assessment involving materiel, supplies, equipment, personnel, and training resources, along with tallies of the training activities completed, are helpful in measuring military readiness. Unfortunately, they provide an incomplete view of readiness, in general, and cognitive readiness, in particular. Morrison and Fletcher (2003) identified ten psychological mechanisms that comprise cognitive readiness: situational awareness, memory, transfer of training, metacognition, automaticity, problem solving, decision making, mental flexibility and creativity, leadership, and emotion. They are summarized in table 1, together with the *relevance* of each component to military operations, ways in which each can be *measured*, and ways in which they might be *trained* (e.g., pedagogy). The table provides several recurring themes, indicating that cognitive readiness may be understood as a combination of three basic abilities to: recognize patterns in chaotic situations (situation awareness, memory, transfer of training);modify problem solutions associated with these patterns as required by the current situation (metacognition, flexibility, and creativity); and implement plans of action based on these solutions (decision making, leadership, automaticity, and control of emotions).

Finally, it shows that, to a significant extent, components of cognitive readiness are measurable and trainable; although, some aspects of cognitive readiness are not amenable to training.

	Table 1. The Components of Cognitive Readiness		
Component	**Relevance**	**Measurement**	**Pedagogy**
Situational Awareness	The ability to perceive and comprehend all relevant elements of the current military situation and to project status into near future	Simulated operations that can be interrupted to compare participants' perceptions with ground truth	Repeated practice and feedback improves situation awareness
Memory	The ability to recall and/or recognize patterns in operational problems for which there are likely solutions	Direct testing of knowledge and skill retention or interrupting simulated operations (as above) and assessing retention of recommended Coast	Tradeoffs exist, but conditions of learning can be designed to enhance retention. Over-learning can enhance retention
Transfer of training	The ability to apply knowledge and skills learned in one context to another context	Assess the application of learning to contexts different from those in which the learning occurred. Assess abstraction of principles from experience	Massive amounts of practice with feedback will enhance 'low-road' transfer. Training in forming mindful, conscious abstraction will enhance 'high-road' transfer
Met cognition	The ability to monitor, assess, regulate, and enhance one's own cognitive processes	Determine the accuracy with which individuals regulate or monitor their own performance in instruction and operations	Most cognitive skills can be enhanced by exercises designed to increase awareness of self-regulatory processes
Automat city	Allows very rapid responses that do not substantially impair other cognitive processes	Determine the ability to complete successfully the tasks in dual processing or visual/memory search modes	Over-learning can produce automatic processing in many consistently mapped tasks.
Problem solving	The ability to analyse the current situation, understand goals, and develop a COA to reach them	Determine the probable success of proposed plans of action when given successively more difficult situations to deal with and goals to achieve	Techniques matched to goal and situation categories can be successfully taught as can the knowledge base needed for 'strong' problem-solving methods
Decision making	Similar to problem solving, but the emphasis is on reviewing different plans of action, assessing the probable impact of each, selecting one, and committing resources to it	Assess competency in formal methods by success in identifying and selecting Coast likely to achieve targeted goals consistent with given utilities. Directly assess quality of decisions vis-à-vis outcomes	Instruction in formal decision-making techniques may improve the quality of decisions, but some aspects of successful decision-making are determined by individual dispositions
Mental Flexibility and Creativity	The ability to generate, adapt and modify Coast rapidly, as required in response to variable situations	'War gaming' that assesses the ability to devise plans and actions that differ from 'DS' solutions and adapt to rapidly changing, unfamiliar situations	Knowledge and skills to widen the range of options considered in military operations can be taught, but higher levels of creativity are more likely to be caused by native abilities
Leadership	Patterns of motivational, technical, and interpersonal knowledge and skills that encourage and support others in carrying out a designated plan of action	Role-playing exercises contrived to provide assessments of leadership and leadership readiness. Different groups and different goals require assessment of ability to adjust leadership style as needed	Technical and conceptual skills can, to an appreciable extent, be taught. Interpersonal skills and patterns of motivation are more dependant on native abilities and more difficult to teach
Emotion	The ability to devise and select appropriate Coast despite states of heightened emotion and stress	Performance in deeply engaging, sensory immersing simulations can be used to assess the ability to overcome emotion and stress	Deeply engaging, sensory immersing simulations may train war fighters to retain critical pieces of information and perform under highly stressful conditions

Source: J. E. Morrison and J. D. Fletcher, 2003, *Cognitive Readiness* (Alexandria, VA: Institute for Defence Analyses), I-1.

<u>Definition of Competency</u>

Australian Land Warfare Doctrine 7-1 (*Individual Training 2004*) defines

"Competence" as the ability to use skills and knowledge to achieve a purpose.[11] The key

competencies comprise of sets of competencies that enable people to transfer and apply

knowledge and skills from one situation to another. These are considered essential for

effective participation in emerging forms of work and an individual's integration into a

rapidly changing workplace. The seven key competencies are identified as:

1. Collecting, analyzing and organizing information

2. Communicating ideas and information

3. Planning and organizing activities

4. Working with others and in teams

5. Using mathematical ideas and techniques

6. Solving problems

7. Using technology

<u>Chapter Summary</u>

This chapter has introduced the reader to the primary thesis question, that being

'does the SOLOC include competencies and learning methodologies that foster higher

order thinking skills in its junior logistic officers in preparation for the twenty-first

century warfighting environment as described within the HNA construct?' The reader

was initially introduced to the Australian Army HNA concept and a number of

assumptions were made. The primary one being that the extant SOLOC does not

adequately prepare the Australian Army Logistic Officer in the revised HNA environment. The critical element of higher order thinking is not embedded in the course competencies. Subsequently, the concepts of "cognitive readiness," "higher order thinking" and "competency" were introduced and how they may be analyzed. Chapter Two will expand on this introduction by providing the reader with a literacy review of the concepts associated with higher order thinking and measurement techniques, prior to presenting a methodology that will be utilized to assess a portion of the current course competencies of the SOLOC (Chapter 3).

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[1]Peter Leahy. 2005, *The Hardened and Networked Army,* On-line. Available from internet http://intranet.defence.gov.au/armyweb/sites/HNA/, accessed 12 February 2006.

[2]Ibid

[3]W. Huitt, 1998. *Critical thinking: An overview*. Educational Psychology Interactive. Valdosta, GA: Valdosta State University. On-line. Available from internet, http://chiron.valdosta.edu/whuitt/col/cogsys/critthnk.html, accessed 13 March 2006.

[4]Ibid.

[5]Ibid.

[6]Ibid.

[7]M.P. Driscoll "*Gagne's Theory of Instruction*" In *Needham Heights* (Massachusetts: Pearson Education Company, 2000) 54.

[8]J.E Morrison and J.D Fletcher, *Cognitive Readiness,* (Institute for Defence Analyses, 4850 Mark Center Drive, Alexandria, Virginia 22311-1882, 2000) I-1.

[9]Ibid.

[10]Ibid.

[11]Commonwealth of Australia - Australian Army, *Land Warfare Doctrine 7-1, Individual Training,* (Doctrine Wing, Doctrine and Simulation Group, Land Warfare Development Centre, Victoria 2004), 45.

CHAPTER 2

LITERATURE REVIEW

PART I: HIGHER ORDER THINKING THEORETICAL PERSPECTIVE

It is the theory that decides what can be observed.

Albert Einstein

Chapter Outline

This chapter is presented in two parts, namely higher order thinking from a theoretical perspective, and how it is measured. When combined, this chapter presents the theoretical perspectives and measurement theories of higher order thinking as a systems approach to behavioral change.

Chapter 1 introduced a systems model of human behavior that included the interaction of three human functions: cognition, affect and conation within any environment to bring about a change in an individual's behavior. Part One of this chapter will concentrate on the literature associated with defining the three human functions: cognition, affect, and conation in more detail with an emphasis on cognition or the process of thinking. The reader will be provided with a literature review of the research of current prominent leaders in the field of higher order thinking. Within the scope of this thesis, a significant portion of Part One is dedicated to defining the research associated with the term *cognition* as this element is the main focus of examination in the following chapters. *Cognition* is defined through a greater examination of Bloom's taxonomy and subsequent higher order thinking theorists, where higher order thinking includes critical and creative thinking skills, problem solving and decision making. Thinking disposition

theory will be described to provide the linkages among the aspects of cognition, affect and conation that result in a change in behavior.

Part Two builds on the principles of higher order thinking discussed in Part One by providing a theoretical perspective of how to develop higher order thinking and thinking dispositions with the view to measuring or assessing cognitive readiness. Whereas Part One provided a detailed literature review of the theoretical aspects that underpin a systems approach to human behavioral change that included the detailed description of higher order thinking and thinking dispositions, this part will concentrate on describing theories underpinning "the learner," "the teacher or facilitator" and "the assessor" and associated methodologies to bring about learning.

Both the elements and their linkages that are described in both parts of this chapter will be utilized to establish an assessment methodology in Chapter Three. This will include an evaluation of the extent to which the SOLOC prepares Australian Army logistic officers to be cognitively ready to meet the needs of the HNA construct (Chapters Four & Five).

Bloom's Taxonomy of Cognitive Domain: A basis for Definition

In the previous chapter the question was proposed as to where to begin in seeking to improve human thinking. The suggested answer was within the definition of the nature of thinking. The previous chapter introduced Bloom's taxonomy of the cognitive domain which serves as the basis for what is now labeled higher order thinking skills. During the 1990s, Lorin Anderson (a former student of Bloom) led a team of cognitive psychologists in revisiting the taxonomy with the view to examining its relevance as we entered the twenty-first century. As a result, Bloom's original six levels of thinking were

replaced with another six levels: remembering, understanding, applying, analyzing,

evaluating and creating.[1] As depicted in table 2, the names of the six major categories

were changed from *noun* to *verb* forms. The reasoning behind this is that the taxonomy

reflects different forms of thinking--thinking is an *active* process. Verbs, not nouns,

describe actions, hence the change. The subcategories of the six major categories were

also replaced by verbs and some subcategories were reorganized.

Table 2. Bloom's 1956 Cognitive Domain Taxonomy and Anderson and Krathwohl's 2001 Revised Taxonomy	
Bloom's (1956) Taxonomy	**Anderson and Krathwohl (2001) Revised Taxonomy**
Knowledge	Remembering Recognise, list, describe, identify retrieve, name …. Can the individual *RECALL* information?
Comprehension	Understanding Interpret, exemplify, summarise, infer, paraphrase ….. Can the individual *EXPLAIN* ideas or concepts?
Application	Applying Implement, carry out, use … Can the individual *USE* the new knowledge in another familiar situation?
Analysis	Analysing Compare, attribute, organise, deconstruct … Can the individual *DIFFERENTIATE* between constituent parts?
Synthesis	Evaluating Check, critique, judge hypothesise ... Can the individual *JUSTIFY* a decision or course of action?
Evaluation	Creating Design, construct, plan, produce ... Can the individual *GENERATE* new products, ideas or ways of viewing things?

Source: Bloom's 1956 Cognitive Domain Taxonomy and Anderson and Krathwohl's
2001 Revised Taxonomy

The knowledge category was renamed. Knowledge is an outcome or product of thinking not a form of thinking *per se*. Consequently, the word knowledge was inappropriate to describe a category of thinking and was replaced with the word *remembering* instead. Comprehension and synthesis were retitled to *understanding* and *creating,* respectively, in order to better reflect the nature of the thinking defined in each category. The major categories were ordered in terms of increased complexity.

As a result, the order of synthesis (create) and evaluation (evaluate) have been interchanged. This is in deference to the popularly held notion that if one considers the taxonomy as a hierarchy reflecting increasing complexity, then creative thinking (the *creating* level of the revised taxonomy) is a more complex form of thinking than critical thinking (the *evaluating* level of the new taxonomy). One can be critical without being creative (judge an idea and justify choices) but creative production often requires critical thinking (accepting and rejecting ideas on the path to creating a new idea, product or way of looking at things).

Huitt (1992) classified techniques used in problem solving and decision making into two groups roughly corresponding to the critical/creative dichotomy. One set of techniques tended to be more linear and serial, more structured, more rational and analytical, and more goal oriented. These techniques are often taught as part of critical thinking exercises. The second set of techniques tended to be more holistic and parallel, more emotional and intuitive, more creative, more visual, and more tactual/kinesthetic. These techniques are more often taught as part of creative thinking exercises. This distinction also corresponds to what is sometimes referred to as left brain thinking

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(analytic, serial, logical, objective) as compared to right brain thinking (global, parallel, emotional, subjective).[2]

Within the Secretary's Commission of Achieving Necessary Skills (SCANS) 1991 report, the authors define thinking skills as "thinking creatively, making decisions, solving problems, seeing things in the mind's eye, knowing how to learn, and reasoning."[3] The International Society for Technology in Education (2000), in its release of the *National Education Technology Standards* (NETS) for students, included critical thinking, informed decision-making, and real-world problem solving through technology. The National Research Council's Committee on Information Technology Literacy (1999) findings included "intellectual capabilities" as being critical to technological fluency, citing "engagement in sustained reasoning" and "expecting the unexpected" as two of the ten key elements that enable students to plan, design, execute, and evaluate a solution. All of these are critical aspects of higher-order thinking and sound reasoning.

Burkhardt et al contends that higher-order thinking in the context of a fast-paced, knowledge-based society requires both divergent and convergent thinking. Divergent thinking uses creativity to play "what if," establishing multiple courses of action and ideas to consider as hypotheses. Convergent thinking enables students to use sound reasoning and common sense to analyze those possibilities to select the hypothesis with the most potential based on a set of criteria for expected outcomes.[4]

<u>Critical Thinking</u>

Critical thinking is one among a family of closely related forms of higher-order thinking including problem-solving, decision making and creative thinking. In the area of critical thinking researchers study how we apply our cognitive processes to evaluating

arguments (propositions) and making decisions. On the other hand, in the area of creative

thinking researchers study how we generate ideas and alternatives that do not fit the

"norm." These two areas are often contrasted as the difference between convergent

thinking (thinking pattern that we use when we want to narrow down and evaluate ideas)

and divergent thinking (thinking pattern we use when we want to expand or develop new

ideas). Huitt (1998) warns against labeling "good" thinking as critical thinking,

cautioning that it implies that creative thinking is a component of critical thinking rather

than a separate, though related, thinking process with its own standards of excellence. It

needs to be recognized that "good" thinking requires both critical and creative thinking.

For example, Duemler and Mayer (1988) (in Huitt 1998) found that when students used

techniques associated with reason and logic (ie. critical thinking) as well as creativity and

divergence (ie. creative thinking), they were more successful in problem solving.[5]

Consensus Statement Regarding Critical Thinking (CT) and the Ideal Critical

Thinker.

> We understand critical thinking to be purposeful, self-regulatory judgment that
> results in interpretation, analysis, evaluation, and inference, as well as explanation
> of the evidential, conceptual, methodological, criteriological, or contextual
> considerations upon which that judgment is based. CT is essential as a tool of
> inquiry. . . . The ideal critical thinker is habitually inquisitive, well-informed,
> trustful of reason, open-minded, flexible, fair-minded in evaluation, honest in
> facing personal biases, prudent in making judgments, willing to reconsider, clear
> about issues, orderly in complex matters, diligent in seeking relevant information,
> reasonable in the selection of criteria, focused in inquiry, and persistent in seeking
> results which are as precise as the subject and the circumstances of inquiry permit.
> Thus, educating good critical thinkers means working toward this ideal. It
> combines developing CT skills with nurturing those dispositions which
> consistently yield useful insights. 6

Critical thinking theorists have made significant contributions to understanding

this area of research. Paul Chance and Richard Mayer delineate the set of operations and

procedures involved in critical thinking.[7] They work to establish the differences between critical thinking and other important aspects of thinking such as creative thinking. Chance reminds us that critical thinking is a process of *thinking to a standard*. Chance postulates that simply being involved in the process of critical thinking is not enough; it must be done well and should guide the establishment of our beliefs and impact our behavior or action.[8]

Contributors from the area of behavioral psychology help to establish the operational definitions associated with critical thinking. They work to define the subtasks associated with final outcomes and the methodologies teachers can use to shape initial behaviors towards the final outcomes. They also demonstrate how educators can establish the proper contingencies to change behavior. Content specialists (such as Hickey and Mertes) demonstrate how critical thinking can be taught in different content areas such as reading, literature, social studies, mathematics, and science. This is an especially important contribution because it appears that critical thinking is best developed as students grapple with specific content rather than taught exclusively as a separate set of skills.[9]

<div align="center">Definitions</div>

John Dewey (1909), the American philosopher, psychologist and educator, is widely regarded as the "father" of the modern critical thinking tradition. He called it "reflective thinking" and defined it as "active, persistent and careful consideration of a belief or supposed form of knowledge in the light of the grounds which support it and the further conclusions to which it tends."[10] By defining critical thinking as an "active process," Dewey contrasts it with the kind of thinking in which you just receive ideas and

information from someone else or through a "passive" process. Critical thinking is one in which you think things through for yourself, raise questions yourself and find relevant information yourself rather than learning in a largely passive way. In defining critical thinking as "persistent" and "careful," Dewey is contrasting it with the kind of unreflective thinking which occurs when someone jumps to a conclusion, or accepts some evidence, claims or decision at face value, without really thinking about it. The "grounds which support" a belief and the "further conclusions to which it tends" in Dewey's definition can be expressed in more familiar language as "what matters are the *reasons* we have for believing something and the *implications* of our beliefs."[11]

Edward Glaser (1941) defines critical thinking as the following: an attitude of being disposed to consider in a thoughtful way the problems and subjects that come within the range of one's experiences; knowledge of methods of logical inquiry and reasoning; and some skill in applying these methods. Critical thinking calls for a persistent effort to examine any belief or supposed form of knowledge in the light of the evidence that supports it and the further conclusions to which it tends."[12] Glaser's definition builds on Dewey's ideas and specifically highlights that critical thinking is partly a matter of having certain thinking skills, but, more importantly, it is also a matter of being disposed to use them. [13]

Robert Ennis (1989) defines critical thinking as "reasonable, reflective thinking that is focused on deciding what to believe or do."[14] While Ennis picks up on earlier definitions with being "reasonable and reflective," he expands on earlier definitions with "deciding what to . . . do." Thus decision making is part of Ennis' critical-thinking concept. [15]

Richard Paul (1993) asserts that "critical thinking is that mode of thinking--about any subject, content, or problem--in which the thinker improves the quality of his or her thinking by skillfully taking charge of the structures inherent in thinking and imposing intellectual standards upon them."[16] Paul's definition highlights the idea that the only realistic way to develop one's critical thinking ability is through "thinking about one's thinking" (metacognition), and consciously aiming to improve it by reference to some good model of good thinking in that domain. [17]

Elder and Paul (1994) state that "critical thinking is best understood as the ability of thinkers to take charge of their own thinking." This requires that they develop sound criteria and standards for analyzing and assessing their own thinking and routinely use those criteria and standards to improve its quality."[18]

Michael Scriven (1997) argues that critical thinking is "an academic competency akin to reading and writing" and is of similarly fundamental importance. He defines it as "skilled and active interpretation and evaluation of observations and communications, information and argumentation."[19] Scriven defines critical thinking as a "skilled" activity for reasons similar to those of Paul, Ennis, Glaser and Dewey. He explains to be critical, thinking must meet certain standards--of clarity, relevance, and reasonableness, etc--and one may be more or less skilled at this. It is an "active" process, partly because it involves questioning and partly because of the role played by metacognition--thinking about your own thinking. He includes "interpretation" because "like explanation, interpretation typically involves construction and selecting the best of several alternatives, which is a crucial preliminary to drawing conclusions about complex claims." He includes "evaluation" because "this is the process of determining the merit,

quality, worth, or value of something" and much critical thinking is concerned with evaluating the truth, probability or reliability of claims. Scriven also includes specific reference to "observations" in his definition. In the technological and media rich environment of the 21st Century, it will be imperative for one to interpret and evaluate what one sees or hears about any given situation or claim. Scriven uses the term "information" to refer to factual claims and the term "communications" to go beyond information to include questions, commands, signals etc. Finally, "argumentation" consists of language presenting reasons for conclusions.[20]

Critical Thinking is NOT

Haskins defines what critical thinking is **NOT:**

1. Thinking critically is not thinking negatively with a predisposition to find fault or flaws. It is a neutral and unbiased process for evaluating claims or opinions, either someone else's or our own.

2. Critical thinking is not intended to make people think alike. For one reason, critical thinking is distinct from one's values or principles, which explains why two people who are equally adept at critical thinking, but have different values or principles, can reach entirely different conclusions. Additionally, there will always be differences in perception and basic emotional needs which prevent us from all thinking the same way.

3. Critical thinking does not threaten one's individuality or personality. It may increase your objectivity, but it will not change who you are.

4. It is not a belief. Critical thinking can evaluate the validity of beliefs, but it is not a belief by itself--it is a process.

5. Critical thinking does not discourage or replace feelings or emotional thinking. Emotions give our lives meaning, pleasure, and a sense of purpose. Critical thinking cannot possibly fulfill this role. Still, emotional decisions that are also critical decisions (such as deciding to get married or have children) should embody critical thinking.

6. Critical thinking does not blindly support everything based on science. For example, our culture is full of bogus scientific claims that are used to market everything from breakfast cereal to breast enhancement pills.

7. It is also important to understand that arguments based on critical thinking are not necessarily the most persuasive. Perhaps more often than not, the most persuasive arguments are those designed to appeal to our basic human/emotional needs rather than to our sense of objectivity. For that reason, it is common for highly persuasive arguments by politicians, TV evangelists, and sales people, among others, to intentionally lack critical thinking." [21]

In summary, "critical thinking may be seen as involving two aspects: a set of *cognitive skills*, and the ability and intellectual commitment to use those skills to guide behavior (*affective disposition*). It does not include simply the acquisition and retention of information or the possession of a skill-set which is not used regularly, nor is it mere exercise of those skills without acceptance of the results."[22]

<center>Core Critical Thinking Skills</center>

The findings of expert consensus published in *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction* define the *Core* (Cognitive) critical thinking skills as outlined in figure 1.
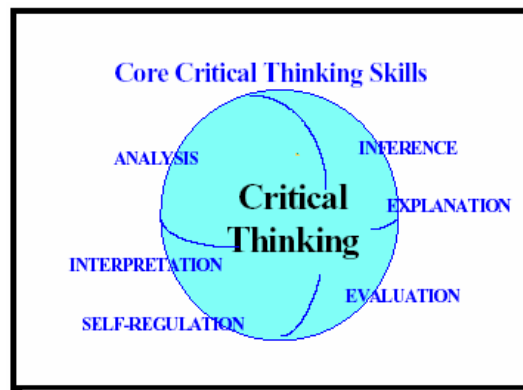
Figure 1.   Core Critical Thinking Skills

These elements, together, make up the technique associated with critical thinking. Each element is equally important and is summarized as:

Interpretation**:** "To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria."[23] Examples include:

1. recognizing a problem and describing it without bias;

2. reading a person's intentions in the expression on his/her face;

3. distinguishing a main idea from subordinate ideas in a text;

4. constructing a way of organizing something you are studying;

5. paraphrasing someone's ideas in your own words;

6. clarifying what a sign, chart or graph means; and

7. identifying an author's purpose, theme or point of view.

Analysis**:** "To identify the intended and actual inferential relationship amongst statements, questions, concepts, descriptions, or other forms of representation intended to express belief, judgment, experiences, reasons, information or opinions."[24] Examples include:

1. Identifying the similarities and differences between two approaches to the solution of a given problem;

2. Identifying the main claim made in a newspaper editorial and tracing back the various reasons the editor offers in support of that claim;

3. Identifying unstated assumptions;

4. Constructing a way to represent a main conclusion and the various reasons given to support or criticize it;

5. Sketching the relationship of sentences or paragraphs to each other and to the main purpose of the passage; and

6. Graphically organizing written work in your own way, knowing that its purpose is to give an overview of information.

Evaluation: "To assess the credibility of statements or other representations which are accounts or descriptions of a person's perception, experience, situation, judgment, belief or opinion and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation."[25] Examples include:

1. Comparing the strengths and weaknesses of alternative interpretations

2. Comparing the strengths and weaknesses of alternative interpretations

3. Determining the credibility of a source of information

4. Judging if two statements contradict each other

5. Judging if the evidence at hand supports the conclusion being drawn

6. Judging if an argument's conclusion follows either with certainty or with a high level of confidence from its premises

7. Judging the logical strengths of arguments based on hypothetical situations

Inference: "To identify and secure elements needed to draw reasonable conclusions, to form conjectures and hypotheses, to consider relevant information and to educe the consequences flowing from data, statements, principles, evidence, judgments,

beliefs, opinions, concepts, descriptions, questions or other forms of representation."[26] Examples include:

1. Drawing out or constructing meaning from the elements in a reading

2. Identifying and securing the information needed to formulate a synthesis from multiple sources; and

3. When faced with a problem, developing a set of options for addressing it.

<u>Explanation</u>**:** "To state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments."[27] Examples include:

1. Constructing a chart which organizes one's findings

2. Writing down for future reference your current thinking on some important and complex matter

3. Siting the standards and contextual factors used to judge the quality of an interpretation of a text

4. Stating research results and describe the methods and criteria used to achieve those result

5. Appealing to established criteria as a way of showing the reasonableness of a given judgment

6. Designing a graphic display which accurately represents the subordinate and super-ordinate relationship among concepts or idea

7. Siting the evidence that led you to accept or reject an author's position on an issue

8. Listing the factors that were considered in assigning a final course grade

Self-regulation: "To self-consciously monitor one's cognitive activities, the elements used in those activities and the results educed, particularly by applying skills in analysis, and evaluation to one's own inferential judgments with a view towards questioning, confirming, validation, or correcting either one's reasoning or one's results."[28] Examples include:

1. Examining your views on a controversial issue with sensitivity to the possible influences on your personal biases or self-interest

2. Monitoring how well you seem to comprehend something

3. Separating your personal opinions and assumptions from those of the author of a passage or text

5. Double checking yourself by recalculating the figures

6. Varying your reading speed and method according to the type of material and one's purpose for reading

7. Reconsidering your interpretation or judgment in view of further analysis of the facts of the case

8. Revising your answers in view of the errors you discovered in your work

9. Changing your conclusion in view of the realization that you had misjudged the importance of certain factors when coming to your earlier decision." [29]

Creative Thinking

> We totally underestimate the value of new ideas. We believe that information, analysis and judgment are enough.[30]
>
> Edward de Bono

The importance of creative thinking in the decision making model cannot be understated. The advancement of modern society can be attributed to the ability of man to think creatively. According to Alec Fisher, creative thinking or innovative thinking is the kind of thinking that leads to new insights, novel approaches, fresh perspectives, whole new ways of understanding, and conceiving of things.[31] The products of creative thought include music, poetry, dance, dramatic literature, inventions, technical innovations, and ways of putting a question that expand the horizons of possible solutions. Even old ideas that are used daily in dealing with routine problems were originally the products of creative thinking.

In a military context, today's strategic leaders are faced with a myriad of unprecedented problems. The effective leader of the twenty-first century must be agile, resourceful and creative. Approaching problems in a creative manner can be problematic and sometimes risky. Individuals operate within their comfort zone given the type of person that they are. Each has their own background, experiences, intellect, view on life and habits. Through reinforced personal experiences, some may be unconsciously inclined not to think creatively.

<div align="center">Definitions</div>

Creative Thinking: Paul Jussel (2000) defines creative thinking as refusing to follow the pattern of operations set by predecessors and devising creative innovative solutions. Creative thinking calls for a "push and pull of ideas" in order to create something of value; a solution to a problem. He further suggests that in reaching dynamic solutions, the right atmosphere within the organization must exist.[32]

Mark Strand (1998) defines creative thinking as the ability of the individual to deal with the myriad of challenges which come their way in daily life.[33] Strand suggests that teaching methodologies that rely upon teacher-centered, lecture based and test orientated instructional methodologies produce individuals that have the ability to memorize vast quantities of rote information and produce it for examinations, but lack the ability to think for themselves. A demonstrated ability to thinking creatively results in the skills required to think outside of instructional familiarity in order to produce innovative solutions to problems.

Dr Liva Pohlman of the University of Texas defines creativity as "putting together apparently unrelated concepts in an innovative way that is effective." Arguably this definition is given greater clarity by the leading authority on creative thinking, Edgar Moore.

Moore (1967) postulates that creative thinking may be cultivated through the consideration of eight tenants. These elements include the Creative Breakthrough, Preparation, Incubation, Persistence, Mechanical Methods, Analogies, Adversity and Practice. The following paragraphs provide further clarity of each tenet:

Creative Breakthrough: Many times in life individuals do not have the time to dedicate thinking creatively to solve problems, especially if a satisfactory and proven answer already exists. Creative thinking is best applied when none of the usual conclusions or proposals is available. The first element in this process is establishing a creative breakthrough, which usually occurs when a series of seemingly unrelated pieces of information are placed together to reveal a possible hypothesis. In general, a creative

breakthrough consists of searching the frame of reference, selecting certain items from it, and combining them in a new way.34

Preparation: Moore (1967) postulates that creative breakthroughs rarely occur to individuals who have not prepared for them.[35] The first three phases of the decision-making cycle establish the framework for making the necessary preparations. Phase One identifies and analyses the problem that the creative breakthrough aims to solve. Phase Two supplies the necessary information not already in the frame of reference. Phase Three is the essential part of the preparation necessary for a creative breakthrough. During this phase tentative conclusions are sort after. The more tentative solutions that are formed, the more likely that a creative breakthrough will be achieved.

Incubation: If a creative breakthrough is not achieved after making a serious effort to complete Phase Three of the decision-making system, a period of incubation is required.[36] It is thought that creative breakthroughs are often achieved during the period of incubation when the individual is focus on some other subject. This suggests that much of our thinking occurs below the conscious level.

Persistence: Providing an incubation period is by no means a guarantee that a creative breakthrough will be achieved. Sometimes, persistent effort is required. Significant creative breakthroughs are likely to require significant effort and persistence in the face of criticism and failure. In many cases, timeframes are measured in years requiring constant dedication and commitment.

Mechanical Methods: Sometimes, creative breakthroughs may not occur even for clearly defined problems where all of the essential information is available in the frame of reference. This is due to the inability of the mind to select and correctly combine this

information.[37] When this occurs, mechanical procedures may be useful. This involves

creating tentative solutions by mechanically putting the information together in a similar

fashion to that of completing a jigsaw puzzle that forms a picture you have never seen

before. This involves selecting at random a piece of information and trying to work out

how this piece fits with the others around it. In the strict sense of definitions, mechanical

methods are not creative thinking per se, but this can be precipitate creative thinking by

forcing the mind to put items into unfamiliar combinations.

Analogies: Moore (1967) defines "analogies" *as the partial resemblances*

between two or more objects.[38] These analogies provide the link between the known and

the unknown and are the primary source for tentative solutions. This tenet of creative

thinking relies upon an individual's experience in dealing with past problems and the

ability to identify and utilize a proven solution to solve similar problems. Little or no

creative thinking is required.

Adversity: Adversity can be a **stimulus** for creative thinking with regard to the

ability of the individual to manipulate this resistance into an advantage. Even when one

cannot twist adversity into an advantage one should at least try to reduce the adversity by

attacking the problem creatively.

Practice: Studies of people who have made important creative breakthroughs

indicate that skill in creative thinking can be acquired through practice.[39] Practice is more

likely to be effective if tests are carried out relating to casual theories in life that may

inhibit creative thinking. These may include instructional techniques that prohibit the

ability of students to diverge from the subject due to established curriculum and time

constraints. Instructors are often faced with the dilemma of whether diverging answers to

questions are either examples of creative thinking or ignorance. This leaves many

students with the conclusion that using creative thinking skills risks possible

misinterpretation and failure, resulting in defaulting back to memorization and

regurgitation techniques.

Thinking Dispositions

> The notion of dispositions is an explanatory construct that addresses the gap between ability and performance by hypothesizing broad character logical traits that dispose some people more than others to marshal their abilities.[40]

Perkins and Tishman

What does it mean to be a good thinker? Traditionally, the answer to this question

has been formulated in terms of cognitive ability or skill. Being a good thinker means

having certain sorts of critical and creative thinking abilities. Good thinkers certainly

have thinking skills. They also have more: motivations, attitudes, values, and habits of

mind all play key roles in good thinking. In an effort to account for the affective and

attitudinal dimension of high-level thinking, many scholars and educators involved in the

thinking skills movement have urged attention to what are often called "thinking

dispositions." Broadly defined, thinking dispositions are tendencies toward particular

patterns of intellectual behavior.[41]

Contemporary attention to dispositions in analyses of intelligence and thinking

began with Robert Ennis (1986). Ennis proposed that an analysis of good thinking in

terms of abilities simply did not suffice and offered a taxonomy of a number of thinking

abilities alongside a number of dispositions. Since Ennis's contribution, several scholars

have dedicated attention to dispositions in their analysis of thinking and intelligence. For

example, dispositions play a central role in Baron's (1985) model of rationality. Baron distinguishes between dispositions and cognitive capacities. Capacity factors like short-term memory determine what in principle a person can do. Dispositional factors, in contrast, determine what a person does do within capacity limits. In particular, Baron analyses good thinking in terms of broad search processes such as searches for possibilities and searches for evidence that one may be more or less well-equipped to carry out (capacities or cognition) and more or less inclined to carry out (dispositions or affect and conation).

Relatedly, Cacioppo and Petty (1982) introduced the dispositional trait "*need for cognition.*" This refers to people's readiness to invest in cognitively demanding activities and enjoyment in such activities. Need for cognition has proven to be a stable individual trait largely independent of psychometric intelligence and showing significant positive correlations with school performance, thoughtful examination of arguments, and related matters (Cacioppo, Petty, Feinstein, & Jarvis, 1996 in Perkins & Tishman, 1998). Further treatments that advance the case for the importance of dispositions--sometimes under that name and sometimes with other labels--include Dewey (1930) (good habits of mind), Facione, Sanchez, Facione, and Gainen (1998), Perkins, Tishman & Jay (1993), Langer (1980, 1989) (mindfulness), Passmore (1967), Paul (1990), Siegel (1988) (critical spirit), and Stanovich (1994) (dispositions toward rationality). [42]

Most authors treat dispositions simply as tendencies. Perkins, Tishman, and Jay (1993), however, introduce a further panacea. They argue that a full account of intellectual behavior requires three logically distinct and separable components*: "sensitivity, inclination,* and *ability."* Sensitivity concerns the awareness of the occasion;

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inclination concerns the motivation or leaning and ability concerns the capability to follow through appropriately. Sensitivity and inclination make up what most authors have merged together into a general tendency. But logically, sensitivity and inclination are quite different from one another. It is perfectly possible to detect a certain kind of situation [sensitivity (or affect/emotion)] but not care to invest oneself in doing something about it [inclination (or conation/volition)]. Accordingly, an investigation of the dispositional side of good thinking needs to take into account both sensitivities and inclinations as somewhat separable contributing factors. [43]

It is important to distinguish the notion of dispositions from that of "emotional intelligence," popularized by Goleman (1995). Certainly dispositions bear a relation to emotional intelligence. They characteristically involve commitment to a particular stance. However, emotional intelligence as defined by Goleman addresses skills and understandings that specifically concern the handling of emotions--the management of one's own as well as sensitive response to others. The scope of the concept of dispositions certainly includes this but extends much more widely. It includes the motivational and cognitive roles emotions play in thinking, such as when thinking is driven by curiosity or a passion for truth. Moreover, dispositions have many non-emotional aspects. A disposition can reflect a habit or policy rather than a felt commitment.[44]

<center>Disposition of Critical Thinkers</center>

The ideal critical thinker can be characterized merely by the cognitive skills he/she possesses, but also by how he/she approaches life and living in general.

<center>35</center>
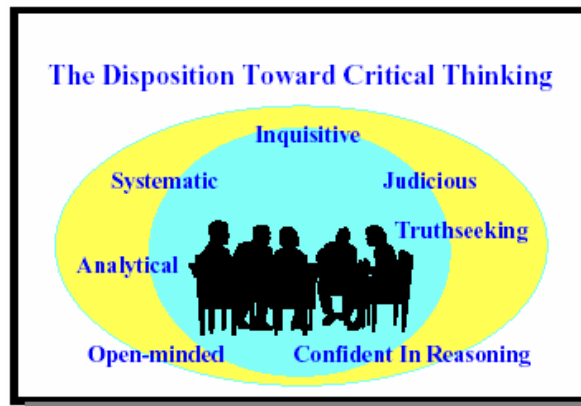
Figure 2.   The Disposition of Critical Thinkers
Source: Core Critical Thinking Skills

The findings of expert consensus published in *Critical Thinking: A Statement of Expert Consensus for Purposes of Educational Assessment and Instruction* define the disposition of critical thinkers as:

1. Inquisitiveness with regard to a wide range of issues;
2. Concern to become and remain well-informed;
3. Alertness to opportunities to use critical thinking;
4. Trust in the processes of reasoned inquiry;
5. Self-confidence in one's own abilities to reason;
6. Open-mindedness regarding divergent world views;
7. Flexibility in considering alternatives and opinions;
8. Understanding of the opinions of other people;
9. Fair-mindedness in appraising reasoning;
10. Honesty in facing one's own biases, prejudices, stereotypes, or egocentric tendencies;
11. Prudence in suspending, making or altering judgments;
12. Willingness to reconsider and revise views where honest reflection suggests that change is warranted;
13. Clarity in stating questions/concerns;
14. Orderliness in working with complexity;
15. Diligence in seeking relevant information;
16. Reasonableness in selecting and applying criteria;
17. Care in focusing attention on the concern at hand;
18. Persistence through difficulties when encountered; and
19. Precision to the degree permitted by the subject and the circumstances.[45]

According to Perkins, Jay, and Tishman (1998), "good thinking" can be characterized as reflecting seven broad thinking dispositions. They state that the ideal thinker is disposed toward all seven thinking behaviors, appropriately exhibiting one or more of them, depending on the thinking occasion. The less-than-perfect (but still good) thinker is disposed toward most of these at appropriate times. Table 3 provides a description of these seven dispositions characterized as a triad of inclinations, sensitivities, and abilities.[46]

Table 3. Key Dispositions for Good Thinking--Perkins, Jay, and Tishman			
Thinking Dispositions	**Key Inclinations**	**Key Sensitivities**	**Key Abilities**
The disposition to be broad and adventurous	The tendency to be open-minded and to look beyond what is given; the impulse to probe assumptions and examine alternative points of view; the desire to tinker with boundaries and play with new ideas; the urge to speculate, generate many options, and explore multiple interpretations	An alertness to binariness, dogmatism, sweeping generalities, narrow thinking, parochialism, and occasions when alternative perspectives are neglected	The ability to identify assumptions, to look at things from other points of view, to generate and review multiple options; brainstorming; empathic thinking; flexible thinking
The disposition toward sustained intellectual curiosity	A zest for inquiry; the urge to find and pose problems; the tendency to wonder, question, probe	An alertness to unasked questions, anomalies, hidden facets; detection of gaps in one's knowledge or understanding; noticing what is unknown or unclear	The ability to observe closely, to identify and challenge assumptions, to formulate and investigate provocative questions, to focus and persist in a line of inquiry
The disposition to clarify and seek understanding	A desire to apprehend things clearly; the impulse to anchor ideas to experience and seek connections to prior knowledge; an urge to sharpen conceptions and examples; a desire to grasp the essence of things	Alertness to unclarity and discomfort with vagueness; alertness to superficiality; detection of occasions needing a sharper focus; a leaning towards hard questions	The ability to ask pointed questions and to build complex conceptualizations; the ability to apply and exemplify ideas, to make analogies and comparisons, to identify and classify details
The disposition to be planful and strategic	The urge to set goals and to make and execute plans; the tendency to approach things in a calculated and/or stepwise fashion; a desire to think ahead.	Alertness to aimlessness, lack of direction, lack of orientation; alertness to off-hand thinking and sprawling thinking	The ability to formulate goals and to evaluate alternative modes of approach; the ability to make and execute plans and to forecast possible outcomes
The disposition to be intellectually careful	The urge for precision; a hunger for mental orderliness and organization; a desire to be thorough	Alertness to the possibility of error, to disorder and disorganization; awareness of the abiding potential for inaccuracy and inconsistency.	The ability to process information precisely, to recognize and apply intellectual standards, to construct order out of disarray

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Table 3. Key Dispositions for Good Thinking--Perkins, Jay, and Tishman			
Thinking Dispositions	**Key Inclinations**	**Key Sensitivities**	**Key Abilities**
The disposition to seek and evaluate reasons	A leaning towards healthy scepticism; the tendency to question the given, to probe assumptions and biases; the drive to pursue and demand justification; the urge to discover underlying grounds and sources.	alertness to evidential foundations; responsiveness to superficiality and over-generalization, a wariness of gaps in knowledge.	The ability to distinguish cause and effect, the ability to identify logical structure; the ability to reason inductively, the ability to weigh and assess reasons
The disposition to be metacognitive	The urge to be cognitively self-aware and to monitor the flow of one's thinking; the impulse to stand back and take stock; the desire to be self-challenging	Alertness to loss of control of one's thinking; detection of complex thinking situations requiring self-monitoring; recognition of the need to look back on a thinking episode	The ability exercise executive control of mental processes, to conceive of the mind as active and interpretive, to be self-evaluative, and to reflect on prior thinking.

Source: Key Dispositions for Good Thinking--Perkins, Jay, and Tishman

> How is thinking best conceived? As a skill/tool? As a disposition/behavior? As a cognitive ability? As a strategy or process? When the teacher fixes his attention exclusively on such matters as these [the acquisition of skills and knowledge], the process of forming underlying and permanent habits, attitudes, and interests are overlooked. Yet the formation of the latter is more important for the future.[47]

Learner Centered Psychological Principles

In November 1997 the American Psychological Association Board of Educational Affairs (BEA) published its findings into research that had been conducted relating to learning centered psychological principles.[48] These findings focus on the psychological factors that are primarily internal to and under the control of the learner rather than conditioned habits or psychological factors. However, the principles also attempt to acknowledge external environment or contextual factors that interact with these internal factors. The principles are intended to deal holistically with learners in the context of real-world learning situations. Thus, they are best understood as an organized set of principles; no principle should be viewed in isolation. The fourteen principles are divided into those referring to cognitive and metacognitive, motivational and affective, developmental and social, and individual difference factors influencing learners and learning

Cognitive and Metacognitive

> **"Nature of the learning process.** The learning of complex subject matter is most effective when it is an intentional process of constructing meaning from information and experience. There are different types of learning processes, for example, habit formation in motor learning; and learning that involves the generation of knowledge, or cognitive skills and learning strategies. Successful

learners are active, goal-directed, self-regulating, and assume personal responsibility for contributing to their own learning.

Goals of the learning process. The successful learner, over time and with support and instructional guidance, can create meaningful, coherent representations of knowledge. The strategic nature of learning requires students to be goal directed. To construct useful representations of knowledge and to acquire the thinking and learning strategies necessary for continued learning success across the life span, students must generate and pursue personally relevant goals. Initially, students' short-term goals and learning may be sketchy in an area, but over time their understanding can be refined by filling gaps, resolving inconsistencies, and deepening their understanding of the subject matter so that they can reach longer-term goals.

Construction of knowledge. The successful learner can link new information with existing knowledge in meaningful ways. Knowledge widens and deepens as students continue to build links between new information and experiences and their existing knowledge base. The nature of these links can take a variety of forms, such as adding to, modifying, or reorganizing existing knowledge or skills. How these links are made or develop may vary in different subject areas, and among students with varying talents, interests, and abilities. However, unless new knowledge becomes integrated with the learner's prior knowledge and understanding, this new knowledge remains isolated, cannot be used most effectively in new tasks, and does not transfer readily to new situations.

Strategic thinking. The successful learner can create and use a repertoire of thinking and reasoning strategies to achieve complex learning goals. Successful learners use strategic thinking in their approach to learning, reasoning, problem solving, and concept learning. They understand and can use a variety of strategies to help them reach learning and performance goals, and to apply their knowledge in novel situations. They also continue to expand their repertoire of strategies by reflecting on the methods they use to see which work well for them, by receiving guided instruction and feedback, and by observing or interacting with appropriate models.

Thinking about thinking. Higher order strategies for selecting and monitoring mental operations facilitate creative and critical thinking. Successful learners can reflect on how they think and learn, set reasonable learning or performance goals, select potentially appropriate learning strategies or methods, and monitor their progress toward these goals. In addition, successful learners know what to do if a problem occurs or if they are not making sufficient or timely progress toward a goal. They can generate alternative methods to reach their goal (or reassess the appropriateness and utility of the goal). Instructional methods that focus on helping learners develop these higher order (metacognitive) strategies can enhance student learning and personal responsibility for learning.

Context of learning. Learning is influenced by environmental factors, including culture, technology, and instructional practices. Learning does not occur in a vacuum. Teachers play a major interactive role with both the learner and the learning environment. Cultural or group influences on students can impact many educationally relevant variables, such as motivation, orientation toward learning, and ways of thinking. Technologies and instructional practices must be appropriate for learners' level of prior knowledge, cognitive abilities, and their learning and thinking strategies.

Motivational and Affective Factors

Motivational and emotional influences on learning. What and how much is learned is influenced by the learner's motivation. Motivation to learn, in turn, is influenced by the individual's emotional states, beliefs, interests and goals, and habits of thinking. The rich internal world of thoughts, beliefs, goals, and expectations for success or failure can enhance or interfere with the learner's quality of thinking and information processing. Students' beliefs about themselves as learners and the nature of learning have a marked influence on motivation. Motivational and emotional factors also influence both the quality of thinking and information processing as well as an individual's motivation to learn. Positive emotions, such as curiosity, generally enhance motivation and facilitate learning and performance.

Intrinsic motivation to learn. The learner's creativity, higher order thinking, and natural curiosity all contribute to motivation to learn. Intrinsic motivation is stimulated by tasks of optimal novelty and difficulty, relevant to personal interests, and providing for personal choice and control. Curiosity, flexible and insightful thinking, and creativity are major indicators of the learners' intrinsic motivation to learn, which is in large part a function of meeting basic needs to be competent and to exercise personal control. Intrinsic motivation is facilitated on tasks that learners perceive as interesting and personally relevant and meaningful, appropriate in complexity and difficulty to the learners' abilities, and on which they believe they can succeed. Intrinsic motivation is also facilitated on tasks that are comparable to real-world situations and meet needs for choice and control.

Effects of motivation on effort. Acquisition of complex knowledge and skills requires extended learner effort and guided practice. Without learners' motivation to learn, the willingness to exert this effort is unlikely without coercion. Effort is another major indicator of motivation to learn. The acquisition of complex knowledge and skills demands the investment of considerable learner energy and strategic effort, along with persistence over time.

Psychological Effects

Developmental influences on learning. As individuals develop, there are different opportunities and constraints for learning. Learning is most effective

when differential development within and across physical, intellectual, emotional, and social domains is taken into account. Individuals learn best when material is appropriate to their developmental level and is presented in an enjoyable and interesting way. Because individual development varies across intellectual, social, emotional, and physical domains, achievement in different instructional domains may also vary. Overemphasis on one type of developmental readiness--such as reading readiness, for example--may preclude learners from demonstrating that they are more capable in other areas of performance. The cognitive, emotional, and social development of individual learners and how they interpret life experiences are affected by prior schooling, home, culture, and community factors.

Social influences on learning. Learning is influenced by social interactions, interpersonal relations, and communication with others. Learning can be enhanced when the learner has an opportunity to interact and to collaborate with others on instructional tasks. Learning settings that allow for social interactions, and that respect diversity, encourage flexible thinking and social competence. In interactive and collaborative instructional contexts, individuals have an opportunity for perspective taking and reflective thinking that may lead to higher levels of cognitive, social, and moral development, as well as self-esteem.

Individual Interests

Individual differences in learning. Learners have different strategies, approaches, and capabilities for learning that are a function of prior experience and heredity. Individuals are born with and develop their own capabilities and talents. In addition, through learning and social acculturation, they have acquired their own preferences for how they like to learn and the pace at which they learn. However, these preferences are not always useful in helping learners reach their learning goals.

Learning and diversity. Learning is most effective when differences in learners' linguistic, cultural, and social backgrounds are taken into account. The same basic principles of learning, motivation, and effective instruction apply to all learners. However, language, ethnicity, race, beliefs, and socioeconomic status all can influence learning. Careful attention to these factors in the instructional setting enhances the possibilities for designing and implementing appropriate learning environments.

Standards and assessment. Setting appropriately high and challenging standards and assessing the learner as well as learning progress -- including diagnostic, process, and outcome assessment -- are integral parts of the learning process. Assessment provides important information to both the learner and teacher at all stages of the learning process. Effective learning takes place when learners feel challenged to work towards appropriately high goals; therefore, appraisal of the learner's cognitive strengths and weaknesses, as well as current knowledge and

skills, is important for the selection of instructional materials of an optimal degree of difficulty. Ongoing assessment of the learner's understanding of the curricular material can provide valuable feedback to both learners and teachers about progress toward the learning goals. Standardized assessment of learner progress and outcomes assessment provides one type of information about achievement levels both within and across individuals that can inform various types of programmatic decisions. Performance assessments can provide other sources of information about the attainment of learning outcomes. Self-assessments of learning progress can also improve students self appraisal skills and enhance motivation and self-directed learning."[49]

Teaching and Assessment Methodologies

Critical thinking and creative thinking are complex activities and we should not expect that one method of instruction will prove sufficient for developing each of its component parts. Carr (1990) postulates that while it is possible to teach critical thinking and its components as separate skills, they are developed and used best when learned in connection with a specific domain of knowledge. We should not expect that a "critical thinking course" will develop students' competencies in this area. If students are not expected to use these skills in traditional training, the skills will simply atrophy and disappear. Instructors at all levels must require students to use these skills in every class and evaluate their skills accordingly. As Hummel and Huitt (1995) have stated "What You Measure Is What You Get." That is, students are not likely to develop these complex skills without specific, explicit expectations and their measurement in the form of important assessments. The Australian Army logistic officer is no different in this regard.

However, even this is not enough for a complete "thinking program." The simple model described above must be combined with a model of creative thinking and these two models must then be combined into a model of problem solving and decision making if we are to more thoroughly understand the components of critical thinking and their

value to the processes of evaluating arguments and propositions as a guide to developing beliefs and taking action. Therefore, it is necessary to include development of creative thinking and practice in using both sets of competencies to solve problems and make decisions in a wide variety of situations. In today's rapidly changing military context, it is solving real problems and making a correct decision that is valued, not simply demonstrating a narrow set of skills in a highly structured military setting.

Framework for teaching thinking. Sufficient research and practice has accumulated to identify core concepts in a framework for developing thinking skills. Although theoretical emphases can differ, the general framework now includes: the need to make thinking skills explicit in a curriculum; teaching thinking through a form of coaching; taking a metacognitive perspective; collaborative learning (including computer-mediated learning); creating dispositions and habits of good thinking; and generalizing the framework beyond a narrow focus on skills to include thinking curricula, thinking classrooms and thinking learning institutions. Considerable evaluation work remains to be done in order to link the critical features of the framework to learning outcomes in different contexts.

Models for delivering thinking skills. Three models for delivering thinking skills have been identified. Interventions can be directed towards enhancing general thinking skills through structured programs which are additional to the normal curriculum. They can target subject-specific learning such as science, mathematics, geography; or they can be infused across the curriculum by systematically identifying opportunities within the normal curriculum for thinking skills development. Whatever

approach is adopted, the methodology must ensure that the learning transfers beyond the context in which it occurs.

Information and communication technologies. Technologies can be linked to the thinking skills framework in several ways and provide a tool for enhancing students' understanding and powers of reasoning through exploratory environments/micro worlds, multi-media and hypermedia. Interactive exploratory environments or micro worlds allow students to direct their own learning through discovery and guided discovery processes. They help make thinking more explicit and enable pupils to hypothesize and experiment with immediate feedback and to facilitate discussion and reflection with peers. Video and multi-media technology is also used to create exploratory environments. They permit students to form rich images of problem situations in multiple modalities and prompt alternative perspectives. Networked communication (local and wide area) provides special opportunities for collaborative learning.

Core Concepts in a Framework for Developing Thinking Skills. Most attempts to teach thinking are based on some formal analysis of the nature of thinking, but what they are all trying to achieve, irrespective of their precise theoretical foundations, is to develop the person's thinking to a qualitatively higher level. McGuinness's (1999) describes the following *core* concepts that have emerged as a result:

1. Developing thinking skills is supported by theories of cognition which see learners as active creators of their knowledge and frameworks of interpretation. Learning is about searching out meaning and imposing structure.

2. Focusing on thinking skills in the classroom is important because it supports active cognitive processing which makes for better learning. It equips students to go

beyond the information given, to deal systematically yet flexibly with novel problems and situations, to adopt a critical attitude to information and argument as well as to communicate effectively.

3. There is a need to be explicit about what we mean by better forms of thinking and of educating directly for thinking. If students are to become better thinkers--to learn meaningfully, to think flexibly and to make reasoned judgments--then they must be taught explicitly how to do it. Several taxonomies of thinking are available. They include some reference to sequencing and sorting, classifying, comparing, making predictions, relating cause and effect, drawing conclusions, generating new ideas, problem solving, testing solutions, making decisions and so on. Some approaches identify multiple intelligences for enhancement--linguistic, logical-mathematical, musical, and kinesthetic.

4. High-quality thinking is emphasized in most approaches and there is a need to design learning tasks which are not routine but have a degree of open-endedness and uncertainty to permit learners to impose meaning or to make judgments or to produce multiple solutions.

5. It is important to give learners the time and opportunity to talk about thinking processes, to make their own thought processes more explicit, to reflect on their strategies and thus gain more self-control. Acquiring and using metacognitive skills has emerged as a powerful idea for promoting a thinking skills curriculum.

Individuals bring their own conceptions (and misconceptions) into the classroom. New knowledge and alternative strategies for thinking are socially constructed in the classroom not only through informed teacher instruction but through practical activities,

dialogue, reflection and discussion with peers. Such socially mediated activities need to be carefully designed from a thinking skills perspective.

Developing better thinking and reasoning skills may have as much to do with creating dispositions for good thinking as it has to do with acquiring specific skills and strategies. For this reason both instructors and students need to have an open-minded attitude about the nature of knowledge and thinking, and to create an educational atmosphere where talking about thinking--questioning, predicting, contradicting, doubting--is not only tolerated but actively pursued.

Increasingly it is recognized that developing thinking skills has implications not only for students' thinking but for instructor development and teacher thinking as well as for the ethos of learning organizations as learning communities.[50]

Model of the Critical Thinking Process. Huitt (1998) proposes a Model of the Critical Thinking Process.[51] This model, represented by figure 3, proposes that there are affective, cognitive, and behavioral aspects of critical thinking that must be considered in addition to the cognitive processes involved. This supports the definitions of Mertes (1991), Scriven and Paul (1992), and Ennis (1992) that include some component of beliefs and behavior. First, a stimulus presents an argument or proposition that must be evaluated. There is an affective disposition to use critical thinking that must activate the critical thinking processes if it is to take place. As a result of critical thinking a previously held belief is confirmed or a new belief is established. This will be established as a component of declarative memory in its semantic form although there may be episodic information associated with it. There may also be images or visualizations formed or remembered as part of the critical thinking process. There is then an affective disposition

to plan and take action in order for the critical thinking to act as a guide to behavior. The cognitive components of goal-setting and self-regulation must be activated in order to develop and implement a plan of action.

Model of Critical Thinking & Its Modification
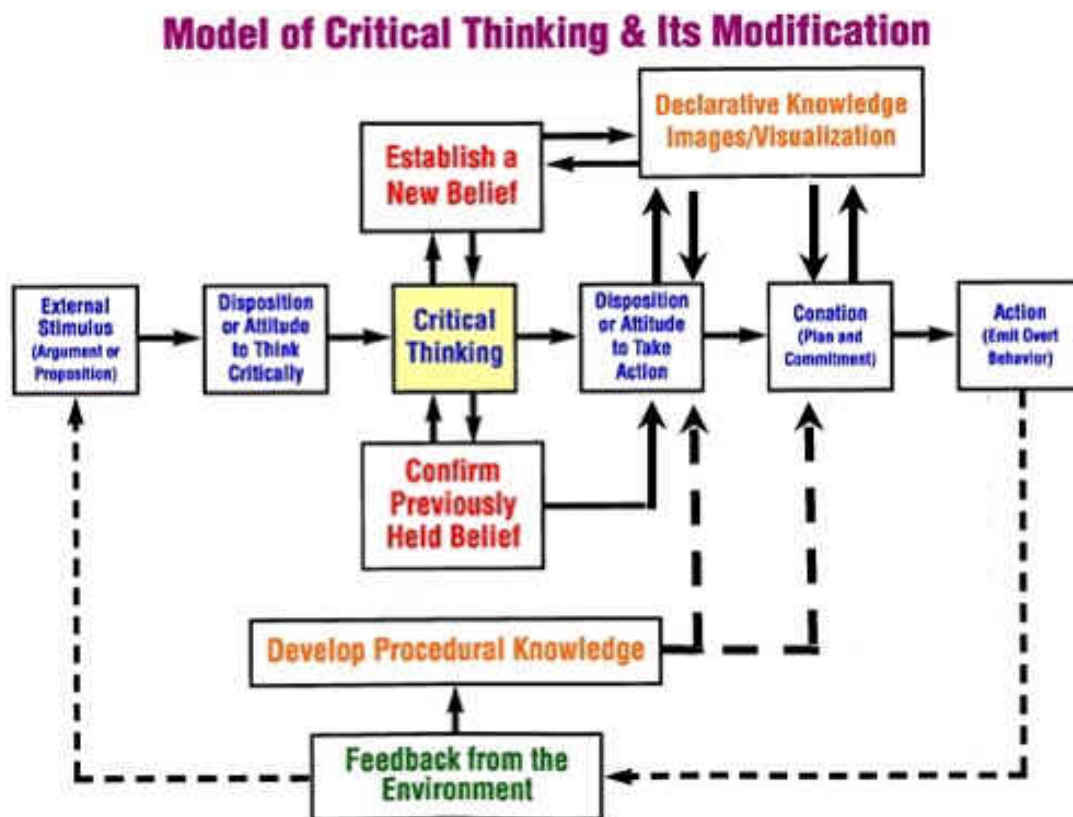
Figure 3.   Model of Critical Thinking
Source: Model of Critical Thinking Huitt, W. (1998). Critical thinking: An overview. *Educational Psychology Interactive*. Valdosta, GA: Valdosta State University. Retrieved [date] from, http://chiron.valdosta.edu/whuitt/col/cogsys/critthnk.html. [Revision of paper presented at the Critical Thinking Conference sponsored by Gordon College, Barnesville, GA, March, 1993.]

As action is taken it results in feedback from the environment and a corresponding increase in procedural knowledge. This new learning is then available as either necessary corrective action taken to guide action toward the desired goal based on

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beliefs or a new situation presents itself that requires additional critical thinking. A complete critical thinking program will successfully deal with each of the components in the model.

The most appropriate teaching methods are possibly different for each component. For example, if one is most interested in impacting declarative knowledge (facts, concepts, principles, etc. that are stored in semantic and episodic memory), the most appropriate teaching method is probably some form of didactic, explicit, or direct instruction. On the other hand, if the focus is on procedural knowledge, it is likely that modeling and/or personal experience would be more appropriate teaching methods. Likewise, if one were trying to impact the memory of images or visualizations, then modeling, active visualizations, or working with pictures might be more appropriate. Attitudes are probably impacted most directly by socialization and the teaching method of cooperative learning. Learning the process of critical thinking might be best facilitated by a combination of didactic instruction and experience in specific content areas. Impacting conation might best be done through goal-setting exercises and action learning. Finally, overt behavior and learning to use feedback might best be accomplished using positive and negative reinforcement.

Very few instructional programs have been designed that explicitly emphasize the dispositional side of thinking. Much of conventional instruction reflects a tacit conception of the teaching/learning process that Tishman, Jay, and Perkin (1992) term the "transmission model." The essence of this model is the instructors' role is to prepare and transmit information to students. The students' role is to receive, store, and act upon this information. A transmission model of teaching encounters fundamental problems when

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the aim is to cultivate dispositions. Consider the three aspects of dispositions: ability, sensitivity, and inclination. Abilities fare best under the transmission model. Instructors can describe and model procedures, explain them, and provide practice and feedback. However, inclinations challenge the transmission model in a fundamental way. Consider, for example, the inclination to make thinking broad and adventurous. Following the transmission model, instructors can easily communicate techniques of doing so (such as brainstorming) and the injunction to do so (you should make your thinking broad and adventurous). However, a student knowing the injunction does not constitute commitment to it. Transmission inherently only passes along the principle, not commitment to it. To accomplish the latter, instructors need not only transmit, but inspire, move, convince, engage, enthrall. Sensitivity presents a similar challenge. Suppose that an instructor wishes to cultivate a sensitivity to occasions where students should think planfully, attending to orderly procedure, checking their work, and so on. Following the transmission model, the instructor can easily communicate conditions under which students should do so, for example while taking an exam or reviewing an assignment prior to handing it in. This may even help somewhat. However, simply because a student has stored away the rule to check work on exams does not mean the student will actually think to apply the rule. Sensitivity requires not just having relevant guidelines in storage but acting on them in relatively uncured conditions. Students taking the exam have to remember for themselves to check their work, in the midst of other pressures.[52]

Thinking skills programs that are successful in the long term ─ successful in the sense that students transfer and internalize their learned thinking skills so that they

become a stable part of their intellectual behavior – *do teach thinking dispositions*, even if that is not their explicit intent. Tishman (1993 and 1995) and her colleagues at Harvard Project Zero suggest a set of criteria based on the idea that thinking dispositions are learned through a process of *enculturation*, rather than direct transmission.[53] Thinking dispositions, they argue, are character logical in nature, and, like many human character traits, they develop in response to *immersion in a particular cultural milieu*. The cultural milieu that best teaches thinking dispositions is a *culture of thinking* – an environment that reinforces good thinking in a variety of tacit and explicit ways. An effective program for teaching thinking dispositions, therefore, should create a culture of thinking in the classroom. Such a culture will have the following four elements:

1. *models* of good thinking dispositions,

2. *explanations* of the tactics, concepts and rationales of good thinking dispositions,

3. peer *interactions* that involve thinking dispositions, and

4. formal and informal *feedback* around thinking dispositions. [54]

For example, suppose the requirement emerges to design or acquire a program to teach reasoning to military officers. If the program is to effectively enculturation strong reasoning dispositions, it should meet the following four criteria.

1. It should provide *models* of good reasoning behavior, for example by providing historical or literary examples of good reasoning, by providing opportunities for the instructor to model reasoning, by structuring experiences in which officers model reasoning for themselves, and by helping officers identify reasoning behavior (or the lack

of it) in everyday situations. The purpose of the *models* criterion is to make sure that officers are provided with exemplars of what thinking dispositions look like in practice.

2. The program should also provide direct *explanations* about the purpose, concepts and methods of good reasoning. In other words, officers should be told why good reasoning is important, and directly taught some key reasoning concepts and moves. For example, they should be provided with explanations about such concepts as evidence, hypothesis, justification, and theory. They should also be provided with explanations about methods for seeking evidence or constructing hypotheses. The purpose of the *explanation* criterion is to ensure that the officers are directly provided with information about the core concepts and methods of the thinking disposition.

3. A program for teaching reasoning should provide plenty of opportunity for peer *interaction* around reasoning. These are interactions in which officers reason together, discuss reasoning with one another, or evaluate reasoning together. The purpose of this criterion is to bring the thinking disposition alive for the officer by anchoring it in meaningful interpersonal interactions.

4. Lastly, the program should provide plenty of opportunities for formal and informal *feedback* around thinking dispositions. Through instructor feedback, peer feedback, and self-feedback, officers should learn about the strengths and weakness of their reasoning behavior. Feedback is one of the most powerful ways a culture teaches and expresses its values, and the purpose of the *feedback* criterion is to make sure that a classroom environment is one in which reasoning behavior is supported, encouraged, and truly valued in a way that is clear to the officer.

One reason to turn to an enculturation model is that some sort of culture in the classroom always exists; we are acculturating whether we recognize it or not, so we may as well take heed and enculture what we want. For example, inevitably, the transmission model enculturates certain sorts of inclinations and sensitivities. Consider a rather rigid version of the model where the students' role is to sit quietly and receive the information they need for the exam. In such an environment, an inclination to be passive with respect to knowledge tends to develop. Students do not become disposed to seek and evaluate information on their own; rather, they learn to count on the environment to automatically feed them information. A classroom culture that cultivates good thinking dispositions presents quite a contrast. Consider a classroom that focuses on one of the thinking dispositions identified earlier ─ the disposition to seek and evaluate reasons. In such a classroom, the environment encourages students to tend towards healthy skepticism. Rather than requiring them to passively take in information, instruction will challenge students to ask questions, probe assumptions, seek justifications. A culture is created in which students learn to be sensitive to the evidential foundations of claims and responsive to superficiality and over-generalization. Along with these inclinations and sensitivities, students learn corresponding thinking abilities, such as the ability to distinguish cause and effect, to identify logical structure, and to weigh and assess reasons. A model of teaching that can usefully guide a teacher in creating a classroom culture that fosters these sorts of inclinations, sensitivities and abilities must be far-reaching and flexible. The transmission model, while helpful for the teaching of abilities, is simply too narrow to meet this larger challenge.

The Enculturation Model: Guidelines for Teaching

The useful thing about models of teaching is that they suggest guidelines for organizing how and what to teach. In any sustained cultural context, it is useful to think of enculturation as occurring in three mutually reinforcing ways: through cultural exemplars, cultural interactions, and direct instruction in cultural knowledge and activities. These three aspects of enculturation – exemplars, interaction and instruction – suggest three straightforward guidelines for organizing teaching: For each thinking disposition one aims to enculturate, one wants to: provide exemplars of the disposition; encourage and orchestrate student/student and teacher/student interactions involving the disposition, and directly teach the disposition. For example, suppose an instructor is concerned with encouraging military officers to develop metacognitive dispositions. That is, they want the officers to be more reflective and evaluative about their own thinking processes as they complete the Military Appreciation Process (MAP) (one of the seven key thinking dispositions). Based on the enculturation model, the instructor decides to organize the instruction and classroom so that the officers are exposed to exemplars of metacognition, have opportunities to interact with one another around metacognitive practices and activities, and receive direct instruction in metacognitive attitudes and techniques. There are a number of guidelines that should be adopted:[55]

Begin by considering how to expose the officers to exemplars of metacognition. Cultural exemplars consist of artifacts and people in the environment modeling or otherwise exemplifying culturally meaningful activities and values. The instructor will need to model metacognition themselves, for example by talking aloud as they are reflecting on their thinking while solving a problem, or by revealing their mental

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machinations while making a careful decision. Instructors may also bring to the officer's attention other exemplars of metacognition, for example in the writings of commanders reflecting on their military decisions in battle or artists reflecting on the creative process. Further, because the enculturation model takes the complete classroom environment into account, instructors will also need to consider visual exemplars that hang on the classroom walls. For example, they might place posters up that exemplify metacognition, either by illustrating a metacognitive tactic (for instance a picture of a soldier with a thought-bubble above him reminding himself to stand back and take stock of his thinking before tacking further offensive action), or by expressing a straightforward slogan that reminds officers to think about their thinking as they work through the MAP.

In addition to providing metacognitive exemplars, instructors may want to cultivate cultural interaction around metacognition. Cultural interactions involve participation in culturally meaningful activities with others, including instructors and peers. Instructor will need to plan to engage the officers in cooperative activities in which they coach each other to articulate, monitor and evaluate their own thinking. For example, one such activity is "pair problem solving," a technique in which the officer would help each other track and improve their thinking aloud while solving a problem. Again, because the enculturation model informs the complete classroom environment, instructors will want to consider the physical space of the classroom and find ways to make it conducive to cooperative interaction. In addition to emphasizing the instructor/officer student cooperative interactions, instructors will also need to make sure that metacognition is a focus of their own interactions with the officers. Asking officers directly about their thinking is one way to do this. But interaction is not always verbal:

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Another important way is to honor metacognition by explicitly providing the officer with the time for reflection. For example, instead of asking the officers to tell them immediately about the thinking they just did on the exam, instructors will need to give them a minute or so of quiet time after the exam to reflect on the thinking they just did. *Then* they should ask them to tell you about it.

Finally, the instructor needs to turn to direct instruction in metacognition. Direct instruction involves the straightforward teaching of culturally important concepts, vocabularies, activities and skills. For example, instructors might plan a series of lessons in which they directly teach subject-specific metacognitive strategies, such as metacognitive strategies for reading. Additionally or alternatively, instructors may decide to teach the officers a general metacognitive strategy for managing their thinking in any cognitively challenging situations. It is here in the area of direct instruction that the transmission model of teaching can be useful in helping to prepare and transmit information about metacognitive knowledge and procedures.

The issue of assessment poses one of the greatest challenges to the concept of thinking dispositions. As Robert Ennis has noted, "a fundamental problem in assessing critical thinking dispositions...is that a disposition is something we want students to evidence on their own ─ without being pushed or prompted to evidence it." Traditional assessments ─ particularly multiple choice exams ─ measure only ability, and tell us nothing about how the learner is disposed to think without external prompts or guidance. Essay exams, such as the Ennis-Weir critical thinking "essay test," do a better job of eliciting students' thinking dispositions, but they don't discriminate between the influence of disposition and ability on performance, and they can even fail to fully reveal

critical thinking abilities, because of students' countervailing dispositional influences. Ennis argues that the most promising way to assess critical thinking dispositions is through guided open-ended opportunities.[56] These are opportunities for students to pursue any pattern of thinking they want, in response to a specific problem situation.

For example, Stephen Norris is exploring assessments that challenge students with an open-ended yet focused problem situation, such as a search for living creatures on another planet. The problem provides students with some information from which it is possible to derive hypotheses, interpretations, and conclusions, although students are not explicitly directed to do so. According to Norris, an analysis of students' responses can reveal the critical thinking dispositions they bring to the task. This form of assessment may be applicable to the SOLOC.

Another quite different approach to the assessment of thinking dispositions is through self-report of attitudes, opinions, beliefs and values. The most well-known example of this approach is the California Critical Thinking Dispositions Inventory (CCTDI), developed by Peter Facione and Noreen Facione. This is a 75 item survey, to which students respond to each item using a six-point Likert scale ranging from "strongly agree" to "strongly disagree." For example, two items chosen at random from the inventory are: *We can never really learn the truth about most things*, and *The best argument for an idea is how you feel about it at the moment*. Based on students' responses to these and similar questions, the CCTDI provides a profile of seven critical thinking sub-dispositions: truth seeking, open-mindedness, analyticity, systematicity, critical thinking self-confidence, inquisitiveness, and maturity. The CCTDI was written to be used at the college-level, but has been adapted with some success to earlier grades.

Unlike the assessments proposed by Ennis and Norris, it is a measure of critical thinking disposition only; it does not measure cognitive ability, nor does discriminate between the contributions of ability and disposition to intellectual performance. The usefulness of this method of assessment in the realm of cognitive readiness will be discussed further in this thesis

A third approach to the assessment of thinking dispositions is currently being developed by David Perkins, Shari Tishman, and Albert Andrade. Based on the Perkins-Tishman-Jay triadic definition of thinking dispositions described earlier, this approach aims to distinguish between cognitive ability, inclination, and sensitivity, and assesses their relative contribution to overall critical thinking performance. The Perkins-Tishman-Andrade assessment instruments consist of a three-task sequence. Each task is designed to isolate one element of the dispositional triad.

In Task One, thinking shortcomings are embedded in a story text ─ shortcomings such as overgeneralization, or a failure to seek alternative options. Students are asked to read the text and identify any problems, puzzles or concerns they have with it. Task One measures sensitivity to thinking occasions. In Task Two (which typically but not necessarily immediately follows task one), the embedded shortcoming are made salient, and students are invited to respond to them directly. Task Two measures inclination and it is similar to the "guided open-ended opportunity" encouraged by Ennis and Norris. Task Three, which typically is administered a few days after Tasks One and Two, reintroduces students to the shortcomings and explicitly asks students to respond to them in a particular way. For example, if the shortcoming consists of a character in a story failing to seek alternative options in a situation where it is important to do so, task three

will explicitly ask students to generate alternative options for the character. In this way, Task Three "stands in" for sensitivity and inclination, and directly measures cognitive ability.

Early testing of the Perkins-Tishman-Andrade prototype instruments indicates that the three-task sequence can reveal reliable information about students' thinking dispositions. However, the instruments are still under development. With the exception of the Facione California Critical Thinking Dispositions Inventory, there is as yet no widely available instrument to assess thinking dispositions, although, in different ways, Ennis, Norris, and Perkins-Tishman-Andrade are all working towards this goal.

Chapter Summary

This chapter provided the reader with clarity and definitions associated with the three elements that make up the system of thinking (cognition, volition and effect) and their linkages through thinking dispositions. This link is important as it articulates how these areas relate to cognitive readiness and the problem solving and decision making processes that will be vital to the Australian Army logistics officer under the HNA construct. This chapter discussed the principles associated with the psychology of higher order thinking, and effective teaching methodologies. This analysis provides further clarity of the principles that, in combination, can result in a training continuum that embraces higher order thinking methodologies. Chapter Three will revisit the principles discussed in this chapter and articulate how these principles will be utilized as an assessment methodology.

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CHAPTER 3

ASSESSMENT METHODOLOGY

Chapter Outline

This chapter will describe the assessment methodology that will be applied to the

SOLOC to determine the extent to which it incorporated critical thinking. This

methodology will take into account the areas of research discussed in the previous two

chapters. At the end of this chapter an "Assessment Matrix" is provided that will be used

to conduct an analysis of the SOLOC continuum.

Assessment Construct

For ease of understanding the assessment methodology to be utilized in this thesis

will be described in two phases. The first phase will build upon the definitions provided

in Part I of chapter 2, and the second phase will address teaching psychology and

methodologies presented in Part II of chapter 2. This research methodology utilizes the

principles outlined in this chapter in order to provide a qualitative analysis of the Training

Management Plan (TMP) that forms the foundations of the SOLOC. These phases are as

follows:

Phase One--Mission analysis and literature review research; and

Phase Two--Survey instrument development.

Phase One

During Phase One, the author identified the research question 'Does the SOLOC

include competencies and learning methodologies that foster higher order thinking skills

in its junior logistic officers in preparation for the twenty-first-century warfighting

environment as described within the Hardened and Networked Army (HNA)?' Based on

a thorough mission analysis, the author developed the following restated research

question, Determine the cognitive readiness requirements that enable logistic officers to

be operationally successful within the HNA, and assess the current state of the SOLOC

against these requirements. Next, a literature review was conducted in the areas of

'Systems Approach to Human Behavior', 'Cognitive Readiness', 'Higher Order Thinking

and Thinking Dispositions' and 'Learner Principles and Teaching and Assessment

Methodologies'. The outcomes of the literature review were predominately presented in

Chapter Two, with the exception of findings about learner psychology principles and

teaching and assessment methodologies which were presented in Chapter Three.

<div align="center">Phase Two</div>

In Phase Two, the author utilized the principles defined in the research conducted

in Phase One to develop a series of survey instruments designed to test the SOLOC TMP

for the theoretical elements identified by the literature review. These elements included

Anderson and Krathwohl's (2001) revised taxonomy, Facione's (1998) core critical

thinking skills, Strand's (1998) theory of instruction, Moore's (1967), McGuinness

(1999), and Paul and Elder (2006) tenants for creative thinking skills, Perkins, Jay and

Tishmans' (1998) key dispositions for good thinking, and The American Psychological

Association's Board of Educational Affairs (1997) learner-centered psychological

principles. These instruments were then reviewed by a senior Royal Australian Army

Educational Corps officer, an Australian Army Training Systems expert, before their use.

Using the quantitative data collected from the survey instruments and independent

research, the author presents the findings, conclusions and recommendations Chapters

Five and Six respectively. Outlined in table 4 is a summary of the survey instrument that was used for the analysis conducted in chapter 4.

Table 4. Assessment Summary Matrix		
Author	**Area of Research**	**Principle**
Morrison and Fletcher	Components of Cognitive Readiness	Situational Awareness
Morrison and Fletcher	Components of Cognitive Readiness	Memory
Morrison and Fletcher	Components of Cognitive Readiness	Transfer of training
Morrison and Fletcher	Components of Cognitive Readiness	Met cognition
Morrison and Fletcher	Components of Cognitive Readiness	Automat city
Morrison and Fletcher	Components of Cognitive Readiness	Problem solving
Morrison and Fletcher	Components of Cognitive Readiness	Decision-making
Morrison and Fletcher	Components of Cognitive Readiness	Mental Flexibility and Creativity
Morrison and Fletcher	Components of Cognitive Readiness	Leadership
Morrison and Fletcher	Components of Cognitive Readiness	Emotion
Facione	Core Critical Thinking Skills	Interpretation
Facione	Core Critical Thinking Skills	Analysis
Facione	Core Critical Thinking Skills	Evaluation
Facione	Core Critical Thinking Skills	Inference
Facione	Core Critical Thinking Skills	Explanation
Facione	Core Critical Thinking Skills	Self-regulation
Moore	Tenants for Creative Thinking Skills	Creative Breakthrough
Moore	Tenants for Creative Thinking Skills	Preparation
Moore	Tenants for Creative Thinking Skills	Incubation
Moore	Tenants for Creative Thinking Skills	Persistence
Moore	Tenants for Creative Thinking Skills	Mechanical Methods
Moore	Tenants for Creative Thinking Skills	Analogies
Moore	Tenants for Creative Thinking Skills	Adversity
Moore	Tenants for Creative Thinking Skills	Practice
Perkins, Jay, & Tishman	Key Dispositions for Good Thinking	The disposition to be broad and adventurous
Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition toward sustained intellectual curiosity
Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition to clarify and seek understanding

Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition to be planful and strategic
Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition to be intellectually careful
Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition to seek and evaluate reasons
Perkins, Jay & Tishman	Key Dispositions for Good Thinking	The disposition to be metacognitive
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Nature of the Learning Process
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Goals of the Learning Process
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Construction of Knowledge
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Strategic Thinking
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Thinking about Thinking
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Context of Learning
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Motivational and Emotional Influences on Learning
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Intrinsic Motivation to Learn
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Effects of Motivation on Effort
Huitt	Models of Critical Thinking Process	Huitt
The American Psychological Association's Board of	Learner-Centred Psychological Principles	Developmental Influences on Learning

Educational Affairs		
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Social Influences on Learning
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Individual Differences in Learning
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Learning and Diversity
The American Psychological Association's Board of Educational Affairs	Learner-Centred Psychological Principles	Standards and Assessment
McGuinness	Core Concepts for Teaching Thinking	Developing thinking skills
McGuinness	Core Concepts for Teaching Thinking	Focusing on thinking skills
McGuinness	Core Concepts for Teaching Thinking	Being Explicit about Better Forms of Thinking
McGuinness	Core Concepts for Teaching Thinking	Evidence of Multiple Intelligences for Enhancement
McGuinness	Core Concepts for Teaching Thinking	High Quality Thinking
McGuinness	Core Concepts for Teaching Thinking	Time and opportunity to Talk about Thinking Processes
McGuinness	Core Concepts for Teaching Thinking	Evidence of Practical Activities, Dialogue, Reflection and Discussion with peers
McGuinness	Core Concepts for Teaching Thinking	Having an Open-minded Attitude about the Nature of Knowledge and Thinking
Huitt	Models of Critical Thinking Process	Affective
Huitt	Models of Critical Thinking Process	Conation
Huitt	Models of Critical Thinking Process	Behavioral Learning

CHAPTER 4

LOAC ASSESSMENT

Chapter Outline

This chapter will articulate the outcome of the analysis conducted on the SOLOC

to determine the extent to which it incorporates critical thinking. This chapter will briefly

introduce the reader to the construct of the SOLOC and the associated Training

Management Plans (TMP). It will also briefly describe how the construct of the TMP

dictates both the Training Outcomes (TO) and assessment criteria's for all courses within

the Australian Army.

Construct of the SOLOC

The SOLOC is comprised of three compulsory courses that requires attendance by

all Australian Army General Service Officers (GSO) and selected Specialist Service

Officer (SSO). The first course, the Logistic Officers Basic Course (LOBC), is conducted

over a six-week period and introduces junior logistic officers at the rank of lieutenant to

basic 'specific to corps' functions and requirements. The majority of this course is

focused upon battalion level operations. The basic teaching methodology for the LOBC is

the Military appreciate Process (MAP).

The second course in this continuum is the Logistic Officer Intermediate Course

(LOIC). The aim of this course is to further advance the skill-set of the logistic officer,

usually at the rank of captain, by introducing planning factors and considerations that

need to be assimilated into the MAP when coordinating sustainment operations for

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brigade level operations. Again, the basic teaching system for the LOIC and methodology is the MAP.

The final course in the SOLOC is the Logistic Officer Advance Course (LOAC). This is the pinnacle of training for the Australian Army Logistician and has been designed to prepare field grade officers with the competencies to be able to provide sustainment planning and support for corps size operations. The LOAC is conducted over a 25 day period of instruction, and consists of two weeks of instructor/guest-lecture facilitated instruction, followed by three weeks of intense MAP analysis and assessment.

As this is the final course in the SOLOC and the pinnacle of training for the logistic officer it has been chosen for detailed analysis in this thesis. Both the TMPs for the LOBC and LOIC have extremely similar competencies and TOs, with the major difference being the level of operation being supported (i.e., LOBC--battalion, LOBC--division). As such, this is the rationale for confining the scope of the analysis to the TMP associated with the LOAC. It is assumed that this analysis and resulting recommendations is consistent across all three courses. Chapter 5 will discuss this in further detail.

Introduction to the Australian Army Training Management Plan

A TMP is designed to outline and describe the Training Establishment (TE) 'ends', 'ways' and 'means' associated with the conduct of recognized and endorsed training courses in the Australian Army. The content within the TMP is crucial as it is the authoritive document for each course. There is little freedom of movement for instructors to vary from the direction articulated in the document and if the competencies and TOs are not structured to provide the appropriate learning outcomes and environment students

will be at a disadvantage in the workplace as they are not being provided with a relevant

workplace-oriented skill set.

The LOAC Training Management Plan

The TMP for the LOAC consist of two sections. Section One lists the occupation,

trade, job and employment stream of the logistic officer. It details the workplace

requirements of the skills that the course will deliver and the authority and methodology

that led to the development of these requirements. Section Two of the LOAC TMP

translates the workplace requirements of trade, job and skill into training requirements

specifically for units of competency to training objectives and summative assessments.

Both sections of the TMP are analyzed in this chapter in order to determine evidence of

higher order thinking. The results of this analysis are detailed in tables 5-13.

Table 5. Assessment Summary--Anderson and Krathwohl (Summative Assessment)			
Author			
Anderson and Krathwohl's (2001)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	Remembering--Can the trainee RECALL information? Applying--Can the trainee USE the new knowledge in another familiar situation? Understanding--Can the trainee EXPLAIN ideas or concepts?	Summative Assessment 1--Group Practical Assessment--Develop a Plan Apply current doctrine Apply principles Use MAP Develop a plan Apply OPORD formats and briefing techniques	This assessment requires each member to work at the cognitive level of *applying*. Thus to be successful, trainees must be able to remember information and understand ideas and concepts. 51 class contact periods are utilized for this assessment (82% of assessment time) after 90 periods of training.
	Analyzing--Can the trainee DIFFERENTIATE between constituent parts?	Summative Assessment 2--Individual Practical Assessment-- Develop ground and situation briefs Conduct reconnaissance	This assessment requires each member to work at the cognitive level of *evaluating*. Thus, each of the preceding thinking levels must be accomplished to be successful at this cognitive level.

Table 5.	Assessment Summary--Anderson and Krathwohl (Summative Assessment)		
Author			
Anderson and Krathwohl's (2001)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	Evaluating--Can the trainee JUSTIFY a decision or course of action?	Produce outline plan and graphic overlay Justify plan	10 class contact periods are utilized for this assessment (16 % of assessment time) after 13 periods of training.
	Creating--Can the trainee GENERATE new products, ideas or ways of viewing things?	Summative Assessment 3-- Individual Theory Service Essay Generate researched argument that supports a logical point-of-view	This assessment requires individuals to work at the highest cognitive level of thinking and expects that one is successful at each of the lower levels. 1 class contact period is utilized for this assessment (less than 1% of assessment time) after 37 periods of training. There is an expectation that trainees draft their service essay prior to commencement of the course.

Conclusions Based on Anderson and Krathwohl (Summative Assessment)

Based on Anderson and Krathwohl's (2001) theory of learning the following

inferences were made from an analysis of the summative assessments required within the

LOAC TMP:

There is an expectation that trainees can apply all of the thinking skills identified

in Bloom's (revised) Cognitive Domain Taxonomy. Thus, they should be applying their

higher order thinking skills successfully.

Anecdotal evidence from commanders suggests that soldiers are not applying

their higher order thinking skills successfully. Thus it could be inferred that there must be

some shortfall in the design of the training, the implementation/execution of the training,

or the learning capabilities of the trainees. Thus further analysis is required of both TOs

within the TMP, the selection and preparation process of instructors, and the selection

and preparation process of trainees.

Detailed in table 6 are the results of the analysis of the TOs in the TMP utilizing

Anderson and Krathwohl's theory:

Table 6.	Assessment Summary--Anderson and Krathwohl (Training Objectives)		
Author			
Anderson and Krathwohl's (2001)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Bloom's Cognitive Domain Taxonomy (Revised)	Remembering--Can the trainee RECALL information?	TO 1.1 Outline logistics management theory	10 periods of training
		TO 1.5 Detail force deployment processes	5 periods of training
		TO 1.9 State the principles of logistics support that are applied to UN and Allied operations	17 periods of training
		TO 3.1 Outline the employment of national power by Defence	2 periods of training
		TO 3.2 Identify the industrial relations principles applicable to military logistics operations	2 periods of training
		TO 3.3 Outline OH&S principles applicable to logistics functions	
		TO 3.4 Outline recent changes in Defence logistics	
		TO 3.8 Outline current logistics issues	2 periods of training
		TO 3.9 Outline the application of private sector logistics to military logistics	
		TO 3.10 Identify the Army's vision for logistics.	5 periods of training
			4 periods of training
			2 periods of training
			2 periods of training
			Total 51 periods (37%)
	Understanding--Can the trainee EXPLAIN ideas or concepts?	TO 1.2 Interpret the principles of the logistics continuum	12 periods of training
		TO 1.3 Interpret the influence of integrated logistics on the levels of war	5 periods of training
		TO 1.4 Explain the logistics requirements for lines of communication operations	
		TO 2.1 Demonstrate the principles of logistics applicable to lines of communication architecture.	2 periods of training
		TO 3.4 Interpret Defence personnel policies	3 periods of training
		TO 3.11 Explain the relevance of technological advances in logistics.	
			5 periods of training
			2 periods of training
			Total 29 periods (21%)
	Applying--Can the trainee USE the new knowledge in	TO 1.6 Employ the MAP to develop a force plan	3 periods of training

Table 6.	Assessment Summary--Anderson and Krathwohl (Training Objectives)		
Author			
Anderson and Krathwohl's (2001)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	another familiar situation? Analysing--Can the trainee DIFFERENTIATE between constituent parts? Evaluating--Can the trainee JUSTIFY a decision or course of action? Creating--Can the trainee GENERATE new products, ideas or ways of viewing things?	TO 1.7 Use the principles of logistics support that are applied to UN and Allied operations TO 1.10 Employ the MAP to develop a force sustainment plan TO 2.2 Employ the principles of siting applicable to a support group TO 2.3 Employ the principles of defence applicable to a support group TO 2.4 Employ measures for the control of the combat service support function of a force TO 3.5 Apply principles of command, leadership and management for logistics unit command TO 3.6 Interpret Defence financial regulations	10 periods of training 22 periods of training 10 periods of training Nil Nil 10 periods of training 2 periods of training Total 57 periods (42%)

Conclusions Based on Anderson and Krathwohl (Training Objectives)

Based on Anderson and Krathwohl's (2001) theory of learning, the following inferences were made from an analysis of the TOs required within the LOAC TMP:

1. Given that 37 percent of TOs are aimed at the lowest cognitive level and a further 21 percent of the TOs are aimed at the next lowest cognitive level, it can be concluded that 58 percent of training time is spent thinking at the lowest levels of cognition.

2. The TMP implies that instructors will concentrate on delivering content for recall, explanation and application rather than developing trainee skills in analyzing, evaluating, and creating.

3. There is an implied expectation that instructors will use learning theories and teaching methods that aim to improve the learners' thinking skills at the lowest levels of Bloom's (revised) Cognitive Domain Taxonomy.

These inferences are in contrast to the cognitive requirements of trainees when completing the summative assessments that were analyzed in table 5. Given that anecdotal evidence suggests that trainees are not applying the higher order thinking skills required of the assessments, a conclusion could be drawn that instructors do in fact concentrate predominately on the lower order thinking skills during their delivery of the content.

To support this conclusion further, an analysis of the time devoted to summative assessments would indicate that the majority of class allocated assessment time (82%) is devoted to the lower cognitive skills area, with the expectation that trainees will complete the higher cognitive level assessments in their own time. Therefore, it is logical to assume that trainees are expected to apply the higher order thinking skills on their own, in their own time.

Facione's Definition of Core Critical Thinking Skills

Table 7.	Assessment Summary--Facione Definition of Core Critical Thinking Skills		
Author			
Facione			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Core Critical Thinking Skills	Interpretation--To comprehend and express the meaning or significance of a wide variety of experiences, situations, data, events, judgments, conventions, beliefs, rules, procedures, or criteria	Summative Assessment 1-- Group Practical Assessment-- Using a current operational scenario, develop a Plan Apply current doctrine	Assessment 1: 51 class contact periods are utilized for this assessment after 90 periods of training. This assessment requires trainees to work as a team to develop a suitable logistical plan. It does require
	Analysis--To identify the intended and actual inferential relationships amongst statements, questions, concepts, descriptions, or other forms of representation intended to express	Apply principles Use MAP Develop a plan Apply OPORD formats and briefing techniques	trainees to apply the core critical thinking skills of interpretation, analysis, evaluation, inference, and explanation. The last skill, self-regulation' might be applied, but there is no evidence within the TMP that it is a

Table 7. Assessment Summary--Facione Definition of Core Critical Thinking Skills			
Author			
Facione			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	belief, judgment, experiences, reasons, information or opinions.		requirement. An inference could be made that trainees will need to apply the other core critical thinking skills to be successful members within their team, although there is no evidence to suggest that they will apply them. The assessment criteria described within the TMP does not utilize the descriptors provided by the Author, which would indicate that the marking guide for this assessment does not stipulate the depth of thought required by the core critical thinking skills.
	Evaluation--To assess the credibility of statements or other representations which are accounts of descriptions of a person's perception, experience, situation, judgment, belief or opinion and to assess the logical strength of the actual or intended inferential relationships among statements, descriptions, questions or other forms of representation.		
	Inference--To identify and secure elements needed to draw reasonable conclusions, to form conjectures and hypotheses, to consider relevant information and to educe the consequences flowing form data, statements, principles, evidence, judgments, beliefs, opinions, concepts, descriptions, questions or other forms of representation.	Summative Assessment 2-- Individual Practical Assessment- -Using the scenario in assessment 1: Develop ground and situation briefs Conduct reconnaissance Produce outline plan and graphic overlay Justify plan	Assessment 2: 10 class contact periods are utilized for this assessment after 13 periods of training. This assessment implies that trainees must interpret information to develop their briefs, they must analyze, evaluate and make inferences to justify their plans; they must explain their plans and apply self-regulation to their plan when conducting reconnaissance.
	Explanation--To state the results of one's reasoning; to justify that reasoning in terms of the evidential, conceptual, methodological, criteriological, and contextual considerations upon which one's results were based; and to present one's reasoning in the form of cogent arguments.		
	Self-regulation--To self-consciously monitor one's cognitive activities, the elements used in those activities and the results educed, particularly by applying skills in analysis, and evaluation to one's own inferential judgments with a view towards questioning, confirming, validation, or correcting either one's reasoning or one's results.	Summative Assessment 3-- Individual Theory Service Essay--on the progression of Defence logistics. Generate researched argument that supports a logical point-of-view	Assessment 3: 1 class contact period is utilized for this assessment after 37 periods of training. There is an expectation that trainees draft their service essay prior to commencement of the course. This assessment requires all of the core critical thinking skills, but there is no evidence within the Assessment criteria that suggests it will be assessed for them.

Conclusions Based on Facione's Definition of Core Critical Thinking Skills

Based on Facione's (1998) definitions of the core critical thinking skills, the

following inferences were made from an analysis of the summative assessments required

within the LOAC TMP:

1. There was no real evidence within the TMP that requires trainees to apply the core critical thinking skills.

2. None of the assessment criteria for each assessment utilized any of Facione's terminology descriptors. (One could imply that these were required, but without it being stipulated within the TMP, there is no guarantee that an instructor would make this implication nor assess or instruct accordingly.)

The result of this analysis strengths the inferences and conclusions drawn from the analysis of the application of Anderson and Krathwohl's (2001) taxonomy.

Strand and Moore's Theory of Instruction

Table 8. Assessment Summary--Strand's Theory of Instruction			
Author			
Strand (1998)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Teaching Methodologies	Teacher-centred, lecture based and test oriented instructional methodologies produce individuals that have the ability to memorize vast amounts or rote information and produce it for exams, but lack the ability to think outside instructional familiarity to produce innovative solutions to problems.	The majority of the TMP TOs (as detailed in the tables above) are in the lower cognitive level of thinking.\n\nThe TMP lists teaching points associated with these TOs.	From the author's experience of attending the course in 2003, the first 2-weeks of the course is dedicated to instructor/guest speaker-centered lectures, with the following 3-weeks centred around application of the Military Appreciation Process (MAP) with an emphasis on the process rather than the thinking skills required to solve a problem. Trainees learn to 'jump through the hoops' of the process to satisfy the assessment requirement rather than generate new thinking or innovative solutions.

	Table 9. Assessment Summary--Moore's Theory of Instruction		
	Author		
	Moore (1967)		
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Tenants for Creative Thinking Skills	Creative Breakthrough	There is no evidence within the TMP that suggests that instructors apply any of the tenants for developing creative thinking	
	Preparation Mechanical Methods Persistence Analogies Adversity	The TOs and the Assessments requires trainees to produce plans. These plans must provide a min of 2 Coast but usually 3.	Anecdotal evidence from past trainees (including myself) would suggest that one COA is usually a 'throw away' and the other two are quite similar--thus not reflecting any real creativity or out of the box thinking. This is accepted by instructors.
	Incubation	The TMP is based on a nine 40 mins period training day between 0800-1600 h 62 periods of assessment @ 40 mins each = 41 ½ hrs (7 days @ 7 ½ hrs/day) 137 periods of training @ 40 mins each = 91 ½ hrs (15 days @ 7 ½ hrs/day)	There is an obvious lack of reflection time (or 'incubation') during the day within the TMP. Any reflection time was in trainees' out of hours (night) time and up to the trainee as no formal guidance/tasking for reflection was set.
	Practice	The TMP indicates that two plans are required (formative assessment and summative assessment)	Time constraints and established curriculum creative an environment that limits the amount of creative thinking allowed, resulting back to memorization and regurgitation of techniques.

Conclusions Based on Strand and Moore's Theory of Instruction

Based on Moore's (1967) and Strand's (1998) theory of instruction (teaching), the following inferences were made from an analysis of the LOAC TMP:

1. The instructional methods employed are predominately instructor centered, lecture or syndicate based and assessment oriented. This type of methodology limits the application of creative thinking.

2. Opportunities to analyze, evaluate, and create through wargaming other syndicate group's proposed COAs are not taken (i.e. trainees may get more out of applying Facione's core critical thinking skills to another plan than going through the whole MAP for a second time.) Rather than repeating the task with a new scenario,

trainees would be able to utilize the limited time to look more deeply at another COA to

the same scenario. A number of COA could be provided for analysis (good and bad); the

intellectual challenge of wargaming these COA would provide a better learning

experience than 'jumping through the MAP process hoops' for a second or third time, if

facilitated well.

The American Psychological Association's Board of Educational Affairs

Table 10. Assessment Summary--The American Psychological Association's Board of Educational Affairs			
Author			
The American Psychological Association's Board of Educational Affairs (1997)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Psychological Principles	Cognitive and Metacognitive Factors: Nature of the Learning Process Goals of the Learning Process Construction of Knowledge| Strategic Thinking Thinking about Thinking Context of Learning	An instructor centred approach is used rather than a learner centred approach.	There is no evidence to suggest that the nature of the learning process supports the construction of knowledge by the learner.
		The TMP clearly outlines the short-term training objectives (goals) of each lesson, as well as the (3) long-term workplace competencies desired from the learning process.	The requirement for instructors to outline the objectives of each lesson as part of their instructional method supports this psychological principle.
		There is no evidence in the TMP to support the successful linkages of prior knowledge to new knowledge to assist construction.	However, anecdotal evidence suggests that syndicate discussions draw on trainees' and instructor's previous experiences to assist understanding.
		The instructor's use of the MAP to bring about learning assists trainees to apply strategic thinking.	However, there is no evidence to suggest that instructors apply any theory to improve individual strategic thinking; rather they rely on the MAP as a process to do this.
		There is no evidence within the TMP that suggests that instructors assist trainees to reflect on how they think and learn, set learning or performance goal for them selves, select their own learning strategies or methods to monitor their own progress towards goals.	There is a distinct lack of evidence that instructors promote metacognitive thinking.
		The TMP and anecdotal evidence suggests that theory is taught via an Instructor centred approach using electronic projection equipment and whiteboards within a training room. Application of that theory is done in a field training area using land cruisers, maps and cell phones in small collaborative groups.	This style of instruction affects the motivational levels of trainees, their orientation towards learning and their thinking styles. Some trainees excel in the field training environment and perform poorly in the classroom and vice versa.

Table 10. Assessment Summary--The American Psychological Association's Board of Educational Affairs			
Author			
The American Psychological Association's Board of Educational Affairs (1997)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	Motivational and Affective Factors: Motivational and Emotional Influences on Learning Intrinsic Motivation to Learn Effects of Motivation on Effort	There is no evidence within the TMP that indicates that there is any application of tasks being novel, challenging, allowing for personal choice or control by the trainees. The learning and assessment activities are repetitive--'more of the same' going through the MAP.	This may have the affect of reducing intrinsic motivation to learn and motivational effort.
	Developmental and Social Factors: Developmental Influences on Learning Social Influences on Learning	The TMP is designed around the preferences of those who learn best in a traditional classroom style of environment that is instructor centred, or through practical exercises within small groups.	The style of instruction caters for the cultural experiences of the Boomer and X generation trainees. It does not cater well for Millennial type trainees that seek information through team learning and group activity; interact with information rather than observe it. They like to multitask and they are impatient.
		The TMP provides numerous syndicate collaborative learning experiences.	Although learning may be enhanced by these collaborative experiences, there is no evidence to suggest that trainees are required to critically listen to members within their group and critically provide feedback within their groups. There may be mislearning occurring in these groups due to 'group think' or other egocentric traits held by members within the group.
	Individual Interests: Individual Differences in Learning Learning and Diversity Standards and Assessment	The TMP evidences an overemphasis on one type of learning style (verbal--preference for using word in both speech and writing).	The instructor centred approach relies on trainees' ability to sit passively for long periods and listen to information or read volumes of text to assimilate information.
		The TMP applies appropriate socioeconomic status to the rank hierarchy during instruction. This assists the motivational effects on trainees.	
		The TMP provides challenging assessments including formative assessments to enable trainees to develop further towards their goals.	

Conclusions Based on the American Psychological Association's
Board of Educational Affairs

Based on The American Psychological Association's Board of Educational

Affairs (1997), the following inferences were made from an analysis of the LOAC TMP:

1. The TMP lacks the majority of the psychological principles necessary to

develop the trainees' cognitive and metacognitive skills.

2. Trainees are not afforded enough opportunity to be creators of their own

knowledge building upon previous experiences and knowledge.

3. The content knowledge required is presented predominately in a passive way in

that trainees are expected to assimilate information passively through a verbal learning

style.

4. There is no explicit attempt to teach or improve the thinking levels of trainees

(either their strategic thinking skills or their metacognitive thinking skills).

5. Learning activities do not promote the psychological principles associated with

motivation and affective factors. They are repetitive (multiple MAP attempts) or they

lack novelty and challenge (passive learning of vasts amounts of doctrinal theory).

6. The teaching approach does not stimulate the psychological principles

associated with developmental and social factors or individual interests by catering

predominantly to only one learning style (verbal) and applying an instructor centered

approach.

Based on these inferences, it could be concluded that the TMP was designed more

for the 'ease of instruction' than it was for the trainees' benefit. If the aim of the course is

to improve the cognitive competencies of the trainees, then the psychological principles

specifically associated with cognitive and metacognitive factors need to be addressed in

full. Catering the other psychological principles will better enhance overall trainee

learning in general.

<u>Perkins, Jay and Tishman's; Paul and Elder; and McGuiness' Critical Thinking Teaching Concepts</u>

Table 11. Assessment Summary--Perkins, Jay and Tishman Critical Thinking Teaching Concepts			
Author			
Perkins, Jay and Tishman			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Key Dispositions for good thinking	The disposition to be broad and adventurous.	There is a lack of evidence that suggests instructors: • develop trainees to see other points of view.	There is no evidence within the TMP that requires instructors to develop the dispositions for good thinking. Dispositions are developed from within; they cannot be imposed by an instructor.
	The disposition toward sustained intellectual curiosity.	There is a lack of evidence that suggests instructors: • challenge assumptions and formulate provocative questions.	There is no evidence to support sustained intellectual curiosity. For example, the scenarios used to apply the MAP are not reused to wargame or trial other Coast.
	The disposition to clarify and seek understanding.	There is a lack of evidence that suggests instructors: • develop the trainees' ability to ask pointed questions, to make analogies.	There is no evidence to suggest that trainees are taught how to question evidence to seek understanding or to make analogies.
	The disposition to be planful and strategic.	There is evidence that suggests instructors: • develop the trainees' ability to think strategically.	There is a heavy emphasis within the TMP to apply the MAP--developing trainees' ability to plan and forecast possible outcomes.
	The disposition to be intellectually careful.	There is a lack of evidence that suggests instructors: • develop the trainee's trainees' ability to apply intellectual standards to their thinking.	There is no evidence to suggest that any intellectual standards are taught or emphasized for usage within the TMP
	The disposition to seek and evaluate reason.	There is a lack of evidence that suggests instructors: • develop the trainees' ability to question, to distinguish cause and effect.	

Table 11.	Assessment Summary--Perkins, Jay and Tishman Critical Thinking Teaching Concepts		
Author			
Perkins, Jay and Tishman			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	The disposition to be metacognitive.	There is a lack of evidence that suggests instructors: • develop the trainees' ability to reflect on their own thinking, to be self-challenging.	There is no evidence to support the concept of reflective thinking (no time is allowed, no specific activities conducted to practice challenging ones own thinking--no collaborative exercises that would suggest that trainees' thoughts/ideas/Coast are being challenged.

Table 12.	Assessment Summary--Paul and Elder Critical Thinking Teaching Techniques		
Author			
Paul and Elder (2006)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
Critical Thinking Concepts and Tools--Model for teaching critical thinking	Elements of Reason: • Purposes • Questions • Points of View • Information • Inferences • Concepts • Implications • Assumptions	No evidence of these elements was discovered.	There is no evidence to suggest that Instructors apply the elements of reason to their method of instruction. The application of an instructor centred approach suggests that trainees are treated as passive learners and are not encouraged to apply the elements of reason within class time. Further there is no evidence that suggests that trainees are required to apply the elements of reason to out of class work.
	Intellectual Standards: • Clarity • Accuracy • Relevance • Logicalness • Breadth • Precision • Significance • Completeness • Fairness • Depth	No evidence of these elements was discovered.	The application of the MAP assists trainees to apply some of these intellectual standards but not in a disciplined way. Trainees are taught how to go through the MAP process, but they are not taught how to apply Intellectual Standards to the outcomes of the process.

Table 12. Assessment Summary--Paul and Elder Critical Thinking Teaching Techniques			
Author			
Paul and Elder (2006)			
Area of Research	**Principle**	**LOAC TMP Descriptor**	**Analysis Result**
	Intellectual Traits: • Intellectual humility • Intellectual autonomy • Intellectual integrity • Intellectual courage • Intellectual perseverance • Confidence in reason • Intellectual empathy • Fair-mindedness	No evidence of these elements was discovered.	The TMP does not specifically provide evidence that instructors develop these traits; however, the Army culture underpins the TMP and thus provides an environment that fosters many of these traits. The result of this area of analysis is similar to that of the Dispositions suggested by Perkins, Jay and Tishman.

Table 13. Assessment Summary--McGuinness's Thinking Teaching Concepts		
Area of Research	**Principle**	**LOAC TMP Descriptor/ Analysis Result**
Core Concepts in a Framework for Developing Thinking Skills	Design learning experiences that allow learners to be active creators of knowledge and frameworks of interpretation.	The TMP provides for a theory lecture series that is instructor centred and does not provide for learners to be active creators of knowledge or frameworks of interpretation.
	Design learning that focuses on thinking skills in classroom.	There is no TMP evidence that supports a teaching approach that focuses on developing thinking skills in the classroom.
	Design learning that explicitly teaches thinking skills.	There are no training objectives or teaching points that focus explicitly on thinking skills.
	Design learning tasks that are not routine or have a degree of open endedness and uncertainty.	There are no learning activities within the lecture series/theory that require non-routine thinking. They are all aimed at the lowest two levels of cognitive thinking (remembering and understanding.) The learning activities that do have a degree of open endedness and uncertainty are those that require the application of the MAP.
	Design learning that allows time and opportunity to develop metacognitive skills.	There is no TMP evidence that time or opportunity is used to develop metacognitive skills.
	Design learning that includes socially mediated thinking skills activities.	There is evidence that socially mediated activities are provided in the form of syndicate discussions and team generated MAP plans. However, there is no evidence that these activities are designed in such a way that emphasizes thinking skills or metacognitive thinking.

Table 13. Assessment Summary--McGuinness's Thinking Teaching Concepts		
Area of Research	**Principle**	**LOAC TMP Descriptor/ Analysis Result**
	Design learning that actively promotes an environment that develops thinking dispositions.	There is limited evidence that indicates that the environment is set up to develop any thinking dispositions. The repetitive experience of applying the MAP might suggest setting up the disposition to be planful and strategic, but there is no evidence of any intellectual standards being applied to the activity.
	Design learning that sets up an ethos for a thinking learning organisation.	Because there is no evidence that suggests that thinking skills are being explicitly taught, there is also no evidence that would suggest that an ethos for a thinking learning organisation exists.

Conclusions Based on Perkins, Jay and Tishman's; Paul and Elder; and McGuiness' Critical Thinking Teaching Concepts

Based on the Critical Thinking Teaching Concepts and tools addressed by

Perkins, Jay and Tishman (1992), McGuinness (1999), and Paul and Elder (2006), the

following inference were made from the LOAC TMP:

1. The design of the TMP lacks a framework for developing trainees' thinking

skills.

2. The TMP is instructor centered, whereby content is presented to trainees, in

most instances, rather than being created by trainees.

3. The application of the content is driven by the MAP (a process for developing a

plan) rather than by any critical thinking model that applies the elements of reason to

appropriate intellectual standards in order to meet appropriate intellectual traits or

dispositions of good thinking.

Chapter Summary

In this chapter the reader was briefly introduced to the three courses that make up

the SOLOC. This was followed by a brief outline as to the construct of the LOAC TMP

and an explanation as to the importance of this document and the competencies included. The majority of this chapter was dedicated to outlining the results of the analysis that was conducted into the LOAC TMP in order to determine the extent to which some of the critical elements of higher order thinking are evident. These results are displayed in tabular format and address the critical elements of research associated with some of the current leading higher order theorists.

The results of this research indicate that there is little evidence to suggest that the elements of higher order thinking, as described by the leading authors in Chapters Two, are currently imbedded in the LOAC. As such, Chapter Five will provide the reader with a summary of this analysis and a detailed recommendation as to how the LOAC could be restructured to ensure that Australian Army Logistic Officers are taught these essential competencies.

CHAPTER 5

CONCLUSIONS AND RECOMENDATIONS

Chapter Outline

This chapter will summarize the conclusions and recommendations that can be drawn from this thesis. This chapter will revisit for the reader the primary and secondary research questions articulated in Chapter One, and provide clarity as to the results and conclusions that have been determined through the analysis presented in Chapter Four. Finally, a recommended restructure of the LOAC TMP will be outlined that should assist with ensuring that higher order thinking competencies are incorporated in this training continuum. The impact of these recommendations will then be considered in conjunction with the SOLOC training continuum.

Thesis Research Questions Revisited

As stated in Chapter 1, and then subsequently revised in Chapter 3, the aim of this thesis was to answer the revised primary research question: "Determine the cognitive readiness requirements that enable logistic officers to be operationally successful within the HNA, and assess the current state of the SOLOC against these requirements." From the analysis conducted in the previous chapter it is proposed that the current TMP construct and teaching methodologies provides little scope for students to learn the theory of, nor inculcate the competencies associated with, higher order thinking.

Though this analysis was limited to the LOAC, the last pinnacle course in the SOLOC, a 'desk-top analysis' by the author of the LOAC TMP and the TMPs of the other courses that combine together to make up this logistic training continuum (i.e.

LOBC & LOIC) suggests that a separate review of the TMPs associated with these courses would produce extremely similar findings. This is due to the distinct similarities in TMP constructs across the SOLOC. However, this analysis is outside of the scope of this thesis.

In seeking to answer the primary question, this thesis explored several themes with respect to the SOLOC. In Chapter Two higher order thinking was defined from a theoretical perspective, including definitions as to the teaching methodology associated with this area of research. In Chapter Three an assessment methodology was briefly introduced that was utilized in Chapter Four to conduct analysis in order to determine the current training/learning environment represented on the LOAC and compared with the current needs identified by the CA. This included an analysis of the training/learning competencies and methodologies currently being applied within the LOAC from a theoretical perspective and consideration as to where on the life-long learning/training continuum the SOLOC fits for logistic officers.

Given the CA's guidance to educate leaders to be 'tough, fit warriors…and decision makers' this analysis suggests that the LOAC does not currently meet his guidance by not incorporating higher order thinking skills that promote sound decisions making skills. In short, the CA has demanded that TC-A develop leaders who know "how to think." The current SOLOC TMP construct fails to incorporate the training objectives that satisfy this requirement, nor the teaching methodologies that enhance/facilitate this learning. The analysis indicates that little evidence exists within the LOAC TMP to indicate that any of the theoretic elements associated with higher order thinking, as discussed in Chapter Two, currently form part of this training continuum. As previously

stated, due to the similarities across the TMPs of the courses that make up the SOLOC, it is reasonable to suggest that this is a consistent factor throughout the SOLOC construct. Through the course content and current training methodologies logistic officers are not benefiting from a learning system that is student orientated and critical thinking centric.

The framework of the SOLOC TMPs does provide some foundations to introduce higher order thinking concepts. In the recommendations detailed below, an abbreviated and revised LOAC is proposed that incorporates some of the critical elements of higher order thinking as discussed in this thesis, utilizing some of the foundations of the extant TMP.

Recommendations

As previously discussed in this thesis, Paul (1993) argues that "reasoning should be recognized to be the essential mode of learning, for only if we are reasoning while we are learning, do we truly figure out what we are striving to learn, and truly make it our own."[1] Based on this premise, it is recommended that the Australian Army LOAC structure be redesigned to incorporate thinking that applies reasoning, or critical thinking. The redesigned LOAC should be based on the premise that the shortcomings of the current structure fails to educate Army officers in the skill of *reasoning* and the importance of the Army's culture, its values and leadership principles, when reasoning.

The central purpose of the redesigned LOAC should be to improve the way logistic officers reason logistically. It should pose logistical questions, seek logistical data and information, acquire logistical concepts, question their non-logistical assumptions, and grasp logistical truths within the Australian Army culture, during the LOAC specifically, and in their workplaces generally. The redesigned course should aim to

develop a thorough understanding of the three fundamental and powerful concepts (critical thinking, Defense values, and Leadership) within the discipline of logistics with the view to developing observant, informed and reasonably thinking senior Australian Army logisticians. To enhance upon this concept, to think through the LOAC content, trainees must:

1. Think through the logic of the course

2. Think through the fundamental and powerful concepts of the course

3. Think through the most central question of the course

4. See the world through the lens of a logistician--the point of view of logisticians,

5. Think in terms of the vocabulary of logisticians,

6. Read and write critically about logistics, and

7. Clarify ideas within the LOAC by stating, elaborating, exemplifying and illustrating them

8. Gather relevant information in daily activities in relation to logistics

9. Engage in an informed conversation with other logisticians or interested parties about some logistical issue that matters

Recommended LOAC Course Structure

All course content within the LOAC can be organized systematically by ideas or the logic of the course. Thus to learn any body of content, it is necessary to learn how to think focusing on the ideas that define the content. The key idea that defines the content of the LOAC is "thinking like a senior Australian Army Logistician." Therefore, the student will understand logistics when he/she can think like a logistician, when he/she can: formulate logistical questions; pursue logistical purposes; gather relevant logistical

information; make reasonable logistical inferences; follow out logical logistical implications; think within a logistical point of view (or multiple logistical viewpoints); clarify and use logistical assumptions; and clarify and use logistical concepts.[2]

Substantive learning will be achieved when the content is understood through thinking, constructed through thinking, modified through thinking, applied through thinking, assessed through thinking and questioned through thinking by engaging in learning theories associated with active learning (reading, writing, speaking, listening, observing, experiencing, collaborating, and coaching). Unlike previous LOACs, students should be required to spend more time in active processing of content and less time passively learning the content. For example, instructors should spend less time lecturing, demonstrating, or explaining the content and more time coaching and observing their students thinking through the content, constructing the content, applying the content, questioning the content, evaluating the content, writing about the content, speaking about the content, reading about the content or experiencing the content, in a reasoned and disciplined way.

By reasoned and disciplined, it is meant that students should analyze reasoning (identifying its elements) and then assess reasoning (using universal intellectual standards). Throughout this active pursuit of content by students, the instructor, as coach or mentor, will help guide students towards internalizing the intellectual traits, Defense values and leadership principles, or put another way, the required disposition of Australian Army logistic officers. The recommended course structure should include the following tenets:

Orientation. Students should be provided with a thorough orientation to the course, both verbally and as a handout. During orientation, a significant amount of time will be used to describe the aim of the course, how the class will be taught (this will be contrasted with how logistics courses have been taught in the past), how it will be assessed (contrasted with how it has been assessed in the past), and what students should be striving to achieve. Students will be provided with the Course Outline and an Orientation Handout (See Appendix A).

Implementation Tactics. Instructors must design activities and assignments that require students to think actively within the concepts and principles of the subject. The following teaching strategies should be applied throughout the course:

1. students will engage in routine practice in internalizing and applying the concepts they are learning and in evaluating their understanding of each;

2. students will be taught how to engage in close reading and will practice it routinely;

3. students will be taught how to assess their own writing, speaking and listening skills and will practice them routinely;

4. assessments will be designed for the purpose of improving students application of the elements of reasoning and intellectual standards in order to develop the required Army officer disposition;

5. students will engage in intellectual work (versus passive learning activities) for significant periods during both class time and reflection time;

6. students will be required to keep an intellectual journal as part of their portfolio of assessments;

7. students will be the center of their learning, and the instructor will act as a coach or mentor and role model;

8. instruction will focus on the fundamental and powerful concepts;

9. significant use of small group and syndicate collaboration activities will occur; and

10. motivational strategies will be applied, such as appropriate arousals (in the form of historical accounts, video/DVD snippets, shared student experiences); or environmental changes (such as in class, in the field (battle space), in the library, field trips, unit demonstrations).

Instructional Techniques

The analysis of the LOAC instructional styles conducted in Chapter 4 indicated that the preponderance of instruction utilized a style of teaching consistent with a combination of instructor focused instruction and student focused instruction. During the instructor focused instruction, students attended lecture style presentations whereby the instructor would present the content via slide presentations or set up guest lecturer presentations. In the existing paradigm, these may then be followed up by some form of student focused activity such as question time, completion of out-of-class assignment, doctrine reading and memorization activity, syndicate (group) planning and discussion activities, or individual/syndicate presentations to the rest of the class.

The restructured LOAC should be totally student centered. Each class should focus on processing content through students continually practicing it, as opposed to a lecture or other passive learning style. Students should be required to understand the content through thinking (ie Richard Paul's concept of cognitive levels). They should

construct it through thinking, modify it through thinking, apply it through thinking, assess their own thinking and question others' thinking.

On a typical day, students should be engaged in disciplined reading, writing, speaking, listening, observing, experiencing, and collaborating in syndicate groups, and coaching themselves and others through the content on the LOAC. Their instructors will serve as their coaches/mentors to guide them through the learning process and to help them improve their thinking skills. These activities should focus on deepening student's understanding of logistics through the elements of reasoning, the universal intellectual standards, the intellectual traits, the Defense values and the principles of leadership. Typical activities should include writing short decision briefs which involves disciplined scientific thinking, close reading of doctrine and policy, teaching doctrinal concepts to peers, listening to historical accounts from guest speakers and paraphrasing their view points, role playing logistical points of view, modeling battle space concepts, evaluating self and others' written and verbal thinking against the intellectual standards, listening to short lectures (10 minutes) and restating in their own words their understanding of what was said either to the whole class or in small groups.

Students should be challenged to continually self monitor their progress and to ask themselves the following question: "Would an independent observer watching me closely conclude that I was engaged in taking charge of my mind, of my ideas about the physical world, of my thinking about that world or would such a person conclude that I was merely going through the motions of doing an assignment, trying to succeed by rote memorization?"

Assessment

Assessment should be both formative and summative. The aim of formative assessment is to improve the student's ability to think like a logistician and to provide them with feedback on their progress towards attaining their goals (or required performance). The feedback provided by formative assessment should be used by the student and the instructor to correct any problems that may be occurring and to indicate whether or not the student is ready to progress to the next stage of content development or competency. Typical formative assessments will include:

1. writing short decision briefs which involve disciplined scientific thinking,

2. close reading of doctrine and policy,

3. teaching doctrinal concepts to peers,

4. listening to historical accounts from guest speakers and paraphrasing their view points,

5. role playing logistical points of view,

6. modeling battle space concepts,

7. evaluating self and others' written and verbal thinking against the intellectual standards,

8. listening to short lectures (10 minutes) and restating in own words an understanding of what was said either to the whole class or in small groups,

9. as part of a planning team, produce logistics plans that address the deployment of third-line logistics support to and sustainment of a force-level military operation. The lines of communication required to support the operation are also to be cited. A current

operational scenario is to be used as the assessment scenario. The planning team is to be part of a notional force-level HQ responsible for planning the operation; and

      10. produce ground and situation briefs, conduct individual reconnaissance, produce an individual outline plan and graphic overlay for the siting of a support group.

      The aim of summative assessment is to determine your level of competence at the completion of any particular competency standard and at the end of the course. Summative assessments should be used to determine whether the student is *competent* or *not yet competent.* There should be no weighting against the pieces of assessment. All summative pieces of assessment should be deemed competent for the student to be deemed successful on the course overall. Summative assessments will include:

      Plan Logistics at Force Level. Individuals, as part of a planning team, are to produce logistics plans that address the deployment of third-line logistics support to and sustainment of a force-level military operation. The lines of communication required to support the operation are also to be cited. A current operational scenario is to be used as the assessment scenario. The planning team is part of a notional force-level Headquarters responsible for planning the operation. (Assessment criteria: Applies current doctrine for force deployment and sustainment, applies the principles of logistics, utilizes the military appreciation process, develops all components of a logistics plan, applies Operational Order formats and briefing techniques, applies critical thinking elements of reasoning and intellectual standards, demonstrates intellectual traits, Defence values and leadership principles.)

      Conduct Logistics Operations at Force Level. Using the same scenario from assessment one, individuals produce ground and situation briefs, conduct individual

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reconnaissance, and produce an individual outline plan and graphic overlay for the siting

of a support group. (Assessment criteria: plans are to include unit and sub-unit

boundaries, circuits, control measures, support requirements, and works priority.

Compromises in technical and Defence solutions must be supported by logical argument,

critical reasoning, intellectual standards, Defence values and leadership principles.)

Manage Logistics Functions at the Rank of Major. Individually, produce a

portfolio of class work made up of 20 short decision briefs (1/day from weeks 2

onwards), 20 disciplined reflective journal entries (1/day from weeks 2 onwards) and a

self-evaluation in which you make a case for your competence (or lack of) as a senior

logistic officer in the Australian Army. (Assessment criteria: written pieces must address

the scope of the topic specified and meet the elements and standards of reason,

application of Defence values and leadership principles, and the Defence writing

standards for format and style.)

In addition to deeming an assessment item as either competent or not yet

competent, it should be further assessed for its application of the three fundamental and

powerful concepts (critical thinking, Defence values and leadership) and assigned a scale

of 1-4. The scale should represent the extent to which the student has evidenced

understanding and internalized the competency (as detailed by its performance indicator)

with the following frequency and depth: (rarely (1); sometimes, but with limited

understanding (2); often, but inconsistently and sometimes superficially (3); and typically

and characteristically, and with depth of understanding (4). This result should be used to

develop the student's final course comment (word picture) and may also be used to

determine the students suitability to return as a course instructor in the future.

Chapter Summary

In this chapter the reader was provided with a summary of the findings from the analysis conducted throughout this thesis. The primary and secondary research questions were revisited and conclusions provided as to the lack of any real indication that the SOLOC currently incorporates higher order thinking within its TMPs. Recommendations were then provided that would restructure the LOAC to ensure that it incorporates these competencies within its continuum.

Thesis Summary

A learning organization is a visionary concept of an organization in which the structure, culture and processes facilitate organizational learning. The Australian Army has always been highly committed to developing the structures, cultures and processes required to facilitate training and to a lesser degree education of its people, thus realizing to some extent the vision of a learning organization. However, like many training institutions, it has reduced the length of its training and education windows to meet the demands of operational tempo and resource shortages, and it has substituted the development of higher order thinking skills with volumes of lower order information and technical content perceived as necessary to operate successfully in the current 'information age'. The analysis conducted in this thesis indicates that the SOLOC is a prime example of a training continuum that has suffered from this. The result is a series of courses in a logistic continuum that fail to embrace the concepts associated with higher order thinking and are reduced to teaching lower order information in an 'instructor-led teaching framework. The CA's guidance is impeccably clear in that he demands leaders

to be 'decision makers'. The current SOLOC construct does little to support this direction.

In short, *it is time for a paradigm shift in the training and teaching methodologies associated with the SOLOC.* You are what you think, and what you measure is what you get. If the twenty-first century logistic officer is to be a professional master with the attributes of cognitive complexity, tolerance of ambiguity, intellectual flexibility, and self-awareness, then these attributes must be taught and measured in an appropriate manner. It is unlikely that Australian Army logistic officers will develop these complex skills without specific, explicit expectations and their measurement in the form of important assessments. For example, the recommended revised course curriculum articulated in this chapter provides a strategic framework that transforms the LOAC into a thinking learning course by applying a higher order systems approach to both teaching and learning.

We can dress it up or down and change the language as much as we want, but the bottom line is that a paradigm shift is required if the Australian Army is to meet the commanders intent of producing logistic officers who can think critically (agile) and creatively (adaptive) and are aware of their thinking (metacognitve) so that they continuously improve. Reflect on a visionary concept--*A Higher Order Thinking SOLOC.*

APPENDIX A

REVISED LOAC ORIENTATION HANDOUT

Welcome to the Logistic Officer Advance Course (LOAC). The LOAC course content is organized systematically by ideas (the logic of the course). To learn its content, it is necessary to learn how to think focusing on the ideas that define its content. The key idea that defines the content of the LOAC is "thinking like a senior Australian Army Logistician." You will understand logistics when they can think like a logistician. This includes the ability to: formulate logistical questions; pursue logistical purposes; gather relevant logistical information; make reasonable logistical inferences; follow out logistical implications; think within a logistical point of view (or multiple logistical viewpoints); clarify and use logistical assumptions; and clarify and use logistical concepts.

In the first couple of lessons, you will be engaged in activities that will help to define the logic of the LOAC. This logic will then be applied to the course elements as detailed in table 14.

Table 14. LOAC Orientation Handout	
Elements of the Course	**LOAC**
Required Course Outcome:	Observant, informed and reasonably thinking Australian Army logisticians.
Central Question:	What is it to think (perform) like a senior Australian Army Logistician?
Fundamental and Powerful Concepts (level 1):	Critical Thinking Defence Values Leadership
Key Concepts (level 2)	Planning Logistics Conducting Logistic Operations Managing Logistics Functions
Key Concepts (level 3):	Plan 3rd line logistics to support force-level operations. Plan logistics for force deployment. Plan sustainment to support force-level operations Conduct logistics operations at force-level. Manage elements of strategic logistics. Manage elements of strategic logistics. Manage a logistics unit. Consider the progression of Defence logistics.
Key Concepts (level 4):	Outline logistics management theory. Interpret the principles of the logistics continuum. Interpret the influence of integrated logistics on the levels of war. Explain the logistics requirement for lines of communication operations. Detail force deployment processes. State the logistics factors affecting deployment. Employ the MAP to develop a force deployment plan. Use the principles of logistics applicable to the deployment of an AS force as part of a coalition force. State the principles of logistics support that are applied to UN and Allied operations. Demonstrate the principles of logistics applicable to lines of communication architecture. Employ the principles of siting applicable to a support group. Employ the principles of Defence applicable to a support group. Employ measures for the control of the combat service support function of a force. Outline the employment of a national power by Defense. Identify the industrial relations principles applicable to military logistics operations. Outline OH&S principles applicable to logistics functions. Interpret Defense personnel policies. Apply principles of command, leadership and management for logistics unit command. Interpret Defense financial regulations. Outline recent changes in Defense logistics. Outline current logistics issues. Outline the application of private sector logistics to military logistics. Identify the Army's vision for logistics. Explain the relevance of technological advances in logistics.

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[1] Paul, Fisher & Nosich, 1993, p4 in Alec Fisher, 2001, *Critical Thinking An Introduction,* Press Syndicate of the University of Cambridge, Cambridge, UK

[2]Ibid. p303